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THE

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Photo] *[Elliott & Fry.*

SIR HERBERT ASHCOMBE WALKER,

General Manager : LONDON & SOUTH WESTERN RAILWAY.
Chairman : RAILWAY EXECUTIVE COMMITTEE.

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Board, constitutes the "Court of Appeal," and in nine cases out of ten his is the responsibility for tactful yet satisfactory action in the matter under discussion. Is a new line of railway proposed, either by another large railway or by a company incorporated for the purpose? The General Manager is the one who has to consider the probable influence it will have upon his own system, and a great deal will depend upon his carefully thought out opinion of the case as to whether the new line is to be supported or opposed. He has to consider the merits of proposed new facilities or train services on his own system; also whether they are likely to justify themselves, or whether whoever is responsible for the suggestion has overlooked the importance of what may be a neutralising or even adverse factor. And in matters of policy; relations with the public, the press and other railways; aspects of legal questions which may arise; and other subjects which are continually calling for attention, together with hundreds of matters relating to the inner working of the railway company's own machinery, it is the General Manager who has to exercise a judicial function, beyond whom is no higher appeal than to the Board itself.

MR. GILBERT S. SZLUMPER, A.M.INST.C.E.

Yet, when one passes behind the scenes, as we have been privileged to do, one finds that the General Manager's Department rarely includes a large staff. Instructions from the Board of Directors in reference to construction of rolling stock, new locomotives, carriages, stations, new lines, and matters of policy are usually transmitted direct from the General Manager to the heads of departments concerned. But for the ordinary work of the department there will probably be only from 20 to 30 members of the General Manager's own staff, even on a railway where a thousand or more clerks are employed in or about the chief offices. A few of these will be typists and general clerks; but the majority are officers of experience and standing, themselves competent to act to a considerable degree on their own responsibility. Most of them are, in fact, in charge of various sections of the General Manager's department.

Detail work figures but little here, except where a sub-department thus constituted is more or less complete in itself. But in other cases each responsible assistant constitutes a link in the chain of connection between the General Manager and a series of sub-departments within the limits of the great executive and traffic departments. Thus, one assistant will be qualified to

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For this purpose we have selected the General Manager's department of the London and South Western Railway, which has been presided over since the retirement of Sir Charles Owens by Sir Herbert Ashcombe Walker, who has the further distinction, besides being one of the youngest of the General Managers of leading British railways, of occupying the position of Chairman, under the President of the Board of Trade, of the Railway Executive Committee, by whom our railways are at present being administered on behalf of the Government.

In the case of the London and South Western Railway we have the additional advantage that the organisation still accords very closely with the system which was for so long characteristic of British methods, and which still obtains in essence, if not in nomenclature, on a majority of our lines. It is true that the Goods Department boasts two chief officers, Mr. Joseph Smeal being Indoor Goods Manager, and Mr. G. T. Hedge Outdoor Goods Manager, while Mr. R. W. Urie, the Locomotive Engineer, is responsible for the locomotive and other work associated with his Department, and Mr. S. Warner is in charge of the Carriage and Wagon Department. But otherwise we find the characteristic organisation, Mr. Henry Holmes still bearing the time-honoured title of "Superintendent of the Line," and Mr. A. W. Szlumper that of "Chief Engineer," with the "Secretary" (Mr. Godfrey Knight), "Solicitor" (Mr. W. Bishop), "Accountant" (Mr. A. E. Newhook), "Docks and Marine Manager" (Mr. T. M. Williams), and others substantially as usual.

Indeed, while a number of changes have been made since Sir Herbert Walker came to Waterloo, these are mainly of a detail character in order to meet the demands of altered conditions and, speaking generally, here we have a good example of a satisfactory scheme of organisation modernised as required, but comprising virtually all standard features.

For dealing with departmental matters requiring the direct attention of the Chief Officers a system of monthly conferences is in force, and this is presided over by Sir Herbert Walker, the respective responsible officers then reporting progress, or presenting matters for consideration. At these meetings are discussed matters to be placed before the Directors, whose meetings usually take place later in the same week, and here the general position of all phases of the company's undertaking is reviewed.

Sir Herbert Walker's personal Assistant is Mr. Gilbert S. Szlumper, A.M.Inst.C.E., who has been acting, since the outbreak of the War, in the capacity of Secretary to the Railway Executive Committee. The London and South Western Railway, being pre-eminently a military line, the calls made upon the Company by the War Department in regard to the transportation of troops, etc., even in peace time, rendered it necessary that an officer with railway and engineering experience should be selected to assist the General Manager in connection therewith. Mr. Szlumper was appointed to his present position in February, 1914, and since the commencement of the War his time has been fully occupied with the work of the Committee. He joined the London and South Western Railway Company's service about 14 years ago, and has had a varied experience in the Engineer's Department; he has held a commission in the Royal Engineers (T.F.) for the last seven years.

The Chief Clerk is Mr. W. Buckmaster, who is responsible to the General Manager for the office organisation. Mr. Buckmaster has a record of 40 years' continuous service with the London and South Western Railway, having commenced his railway career as junior clerk at a country station in 1875. Before his appointment in the office of the General Manager he had acquired a good all-round knowledge of the various branches of the work in the Traffic and Goods Departments, and as a "Relief" or Travelling Clerk, became thoroughly acquainted with the general routine of the business throughout the whole of the line. The experience thus gained was most helpful to him on his promotion to the Headquarters Staff some 25 years ago. After serving as Chief of the Staff in the Superintendent of the Line's Department for five years, he was selected to fill a vacant appointment in the Office of the General Manager.

Notwithstanding the arduous nature of his ordinary duties, he has always taken a keen interest in the various movements with which the Company's employés are more or less associated. As Hon. Secretary of the Brunswick Institute and Club, his assistance and advice to the Committee of the Club have been ungrudgingly given for many years. In 1899 he organised the South Western centre of the St. John Ambulance Association, and since that time has had the satisfaction of signing, as Hon. Secretary, between 2,000 and 3,000 certificates of efficiency in "First Aid to the Injured"

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gained by the employés of the Company in all grades and branches of the London and South Western service.

Being an expert rifle shot, he was much impressed at the time of the Boer War by a speech made by the late Lord Salisbury on the importance of training every man in this country in the use of the rifle. This led to the formation in 1900 of the London and South Western Railway Rifle Club, in which he has been Captain, Secretary, Treasurer and Chairman of Committee. This Club was one of the earliest to affiliate with the National Rifle Association, and at the first competition between Rifle Clubs, for a valuable trophy offered by Sir Arthur Conan Doyle, he was one of the four members of the winning team. On the occasion of the opening of the Club's splendid indoor rifle range at Clapham Junction, he had the honour of receiving the late Lord Roberts, who fired the first shot and afterwards made a most impressive speech. His lordship implored those present to do all they possibly could to assist in the Rifle Club movement, and strongly urged them to read Count Bernhardi's book on "Germany's Next War." This was in 1905, and his lordship concluded his remarks with the following prophetic words:—"I may not live to see the day, but some of the younger men here will undoubtedly do so, when the importance of National Service and the necessity for using a rifle will be forced upon you."

It may here be mentioned that the Directors and General Manager of the Company have given their support and encouragement to the above-mentioned clubs, and in connection with the South Western centre of the St. John Ambulance Association, they offer each year a Challenge Shield, medals and money prizes for competition amongst the employés.

The sub-divisions or sections of the General Manager's Office may be classified as under:—

1. General Correspondence.
2. Staff.
3. Statistical.
4. Publicity and Continental.

General Correspondence.

The scope of the business conducted in this department is of a varied and far-reaching character, and it is here that the numerous points of reference for the General Manager's ruling are classified and the necessary detailed information prepared for his consideration; consequently it is not only useful, but absolutely necessary that the Staff engaged in this department should have had practical experience of the outdoor business as well as a general insight into the working of all the various departments presided over by the Chief Officers of the Company.

The method of conducting the correspondence as well as the registration and careful indexing of all subjects, is of the highest importance, and in this the Chief Clerk is ably assisted by Mr. W. T. Hopgood as Chief Correspondence Clerk, and Mr. E. F. Judd, who is responsible for the registration and filing of the vast amount of correspondence dealt with daily.

As a detail of the organisation and administration of a great railway company, it goes without saying that many representatives of trading firms, members of the travelling public, inventors, and others endeavour from time to time to obtain an audience, if possible, with the General Manager. To Mr. C. H. Barfoot is entrusted the duty of interviewing the numerous callers and of deciding whether their business is of such a nature as to warrant the matter being brought under the personal notice of the General Manager.

In addition to the foregoing Mr. Barfoot fills the position of Secretary of the Carriage and Wagon Committee which is composed of various Departmental Officers who meet from time to time to discuss with the General Manager all matters affecting the construction, re-building, alteration, etc., of the Company's rolling stock.

The requirements in this direction are carefully thought out, and the recommendations of the Committee submitted to the Directors through the General Manager.

Mr. Barfoot entered the Company's service as a junior clerk under the late Sir Charles Scotter in 1886, and during the latter part of that gentleman's reign at Waterloo was brought into close personal contact with him. Later, when Sir Charles Owens was appointed General Manager, he served him in a secretarial capacity for a period of nearly 13 years, during which time Sir Charles occupied that important position.

Staff.

Mr. A. Harris is in charge of all matters pertaining to the Staff, both Clerical and Wages, dealing with and submitting to the General Manager all the more important matters affecting wages, hours of labour, Conciliation Boards, deputations, grievances,

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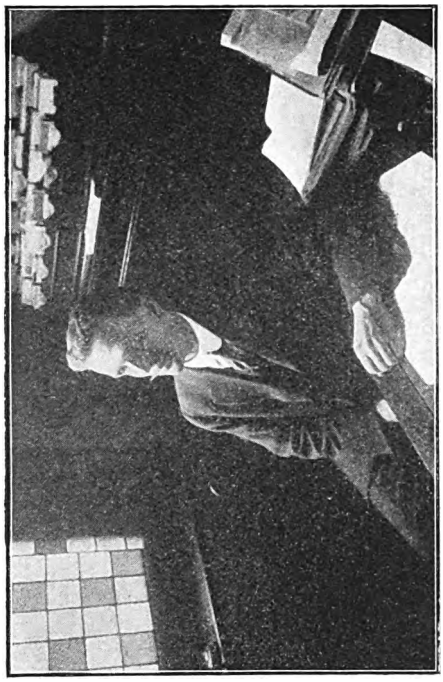
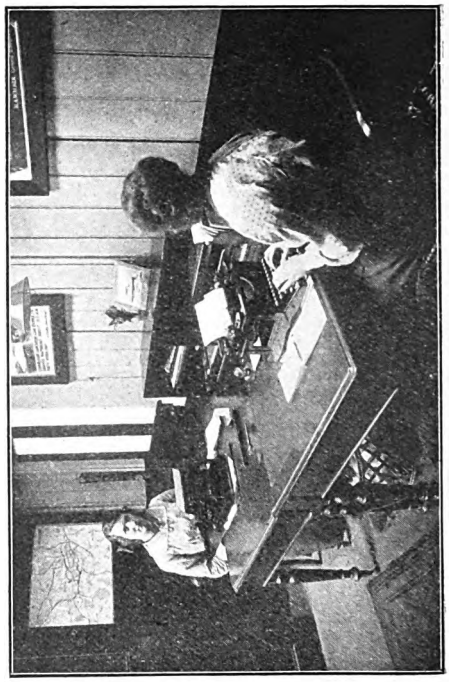
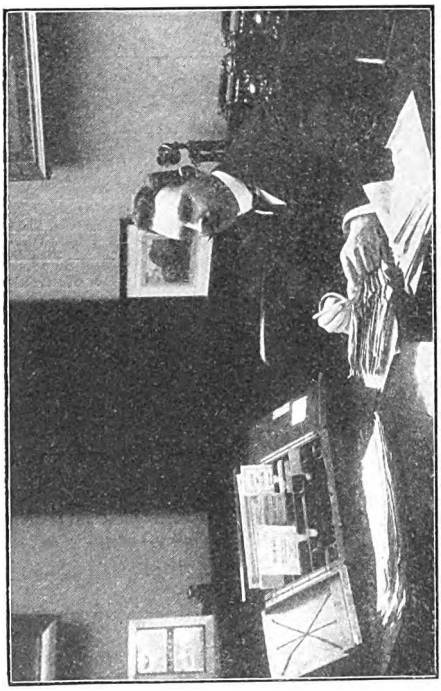


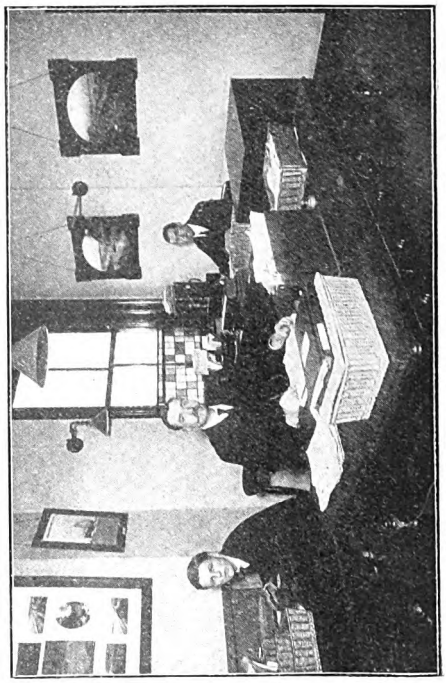
MR. J. HARRAD.



PUBLICITY DEPARTMENT: TYPISTS.



MR. F. V. MILTON.



PUBLICITY DEPARTMENT; GENERAL OFFICE.

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three years ago. Before then the advertising business was dealt with in the respective departments concerned, but amplification of its scope amounting virtually to that of a Commercial Department rendered it desirable to constitute it directly under the General Manager. It was placed in charge of Mr. F. V. Milton, with Mr. J. Harrad as his chief assistant, and here all matters affecting what may be described as "obtaining traffic" or "bringing grist to the mill" are dealt with; hence the aim of the department is DEVELOPMENT. This follows four distinct lines, viz., residential, agricultural, industrial and seaside and holiday resorts. The work in connection with the latter is best known on account of the general publicity which has to be obtained, but it may be mentioned that the department is not only concerned with the preparation of booklets, posters, press advertising, etc., but also works in harmony with the various resorts, Mr. Milton attending the special advertising meetings of the local authorities, and advising them as to the best way in which money raised for publicity purposes should be expended. The department also makes recommendations as to special facilities which it may be desirable to introduce for the development of districts, and in regard to the representation of the Company by Ticket Agents throughout the country.

The "Residential" is a highly important section, particularly in view of the approaching electrification of the suburban system, and the department not only advertises the train service, fares, season ticket rates, etc., but gives useful information as to housing accommodation, etc.

The "Agricultural" section resulted from the instruction of the General Manager to develop as far as possible the sparsely populated agricultural districts served by the line. One opportunity arose as a direct consequence of the War, the shortage of sugar bringing into prominence the possibilities of sugar beet being grown in this country in sufficient quantities to supply the nation's needs. In connection with this, meetings have been arranged in various agricultural centres at which experts have lectured to farmers as to the possibilities and profits of sugar beet culture, and notwithstanding the many difficulties in the way of shortage of labour, and dislike of farmers to introduce changes in cultivation, it is gratifying to state that some forty farmers in Hampshire, Wiltshire, Dorset and Devon are growing crops this year, from seed supplied by the department at cost price. Other movements of a similar nature are in hand.

The "Industrial" section is likewise the outcome of the General Manager's plan to develop the South Western system, and so far as this phase of the business is concerned the department, working in conjunction with the various Estate Agents, is in a position to give manufacturers useful information as to where sites suitable for works, etc., are to be obtained.

Another distinct section of the department is the Continental. The London and South Western being one of the principal railways engaged in the Cross Channel traffic, with regular passenger services to Havre, Cherbourg, St. Malo, Granville and the Channel Islands as well as cargo services to Honfleur and Roscoff, it is apparent that a considerable Continental business is carried on, and although the bulk of the arrangements are dealt with by the Dock and Marine Manager, Mr. T. M. Williams, at Southampton, important questions of a special character constantly arise, which require the consideration of the General Manager. A Continental section was therefore created by Sir Herbert Walker some eighteen months ago and attached to the publicity department under the supervision of Mr. Milton, who in addition to a varied experience in the Traffic, Goods and General Manager's Offices, has for some years had considerable dealings with matters affecting the Company's Continental trade, and possesses a useful knowledge of several languages.

On Active Service.

The following members of the General Manager's staff are at the present time either "somewhere in France" or waiting orders to proceed there:—Messrs. P. Hamon, P. Gill, G. V. Metcalfe, A. Berriman, F. Gilbert and G. H. V. Couch; in addition Messrs. H. R. Peters, E. Uzzell and C. Salisbury have temporarily left the office to assist the staff of the Railway Executive Committee. The places of these members have been filled by Junior Clerks under military age and the engagement of lady typists, and it may be mentioned that the first lady typist appointed on this line was to fill a vacancy in the General Manager's Publicity Department.

In conclusion, a few remarks may be made in reference to Sir Herbert Walker

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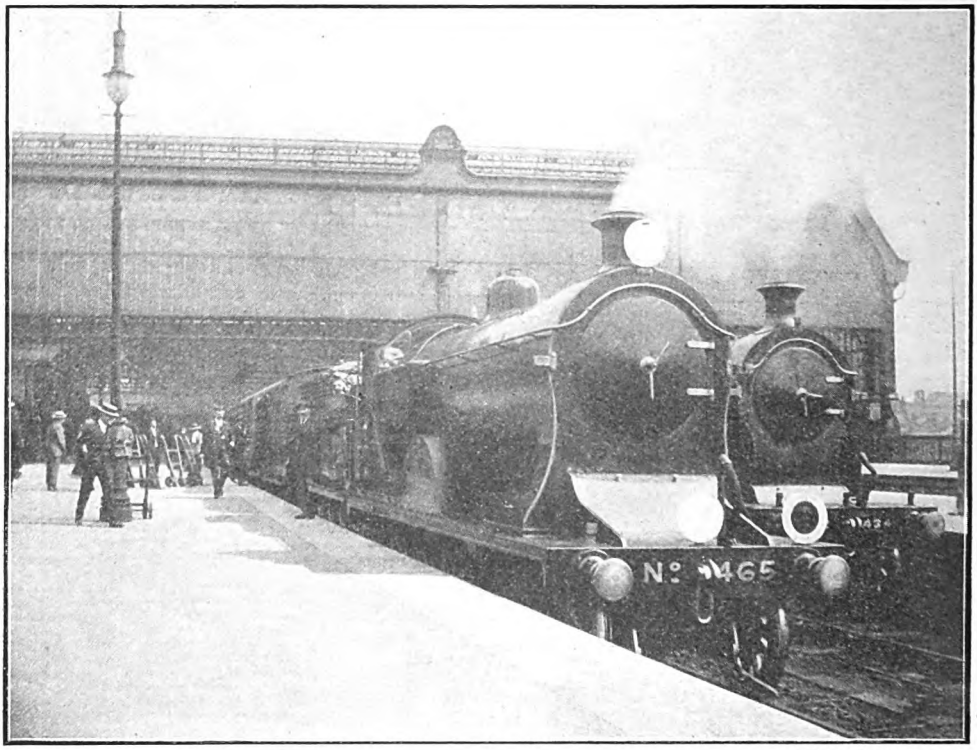
himself, though there is little which can be said which has not already been expressed. Sir Herbert has had the advantage of a special training fitting him for such a position as that he now holds, and on the London and North Western Railway had peculiar opportunities. That he took advantage thereof is shown by his subsequent record, and although coming to Waterloo from the service of a railway whose traffic and conditions include many features quite strange to the London and South Western Railway, there is no doubt whatever that his appointment has proved eminently satisfactory. His record is that of a tactful, cool-headed and capable administrator, and the tribute rendered by the staff is that he is just where justice is called for, and generous where circumstances call for generosity.

Although only 47 years of age, and except for Mr. Guy Calthrop, the youngest General Manager in the service of the great railways, a wide experience has been crowded into the 30 years which have elapsed since he entered railway employ. The son of a medical practitioner, he was trained with a view to follow the same profession. His education began at North London Collegiate School, was continued abroad, and completed by private tuition. He then passed the Apothecaries' Hall examination, but for family reasons, abandoned medical studies, and entered the railway world. This was in April, 1885, when, as a clerk, he made his first appearance in the office of the District Superintendent of the London and North Western Railway at Euston, under Sir Robert Turnbull. There he remained for two years and a half, to be transferred to the office of the Superintendent of the Line, over which Mr. G. P. Neele then presided. Having passed through the departments dealing with the working of trains, Sir Herbert Walker was, in January, 1889, appointed outdoor assistant to the Superintendent of the Line. After four years' experience in the latter capacity he was promoted to the position of Assistant District Superintendent in the North Wales Division, with headquarters at Chester. Ten months later he was invited to become



Photo] [*F. H. Stingemore.*

LONDON AND SOUTH WESTERN RAILWAY.

West of England Express at Waterloo. 4-4-0 Locomotive, No. 465.

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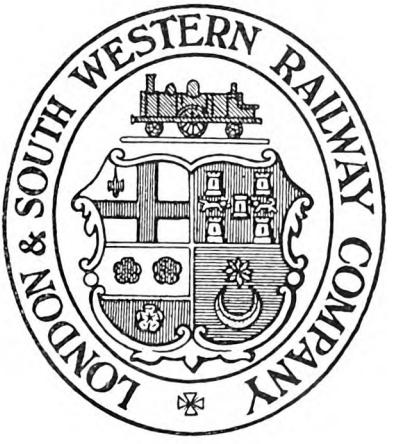
Assistant District Superintendent of the Southern Division extending from London to Stafford, and this appointment necessitated his removal to Euston. Having ably discharged the duties of that office for nine years, he became District Superintendent, and soon afterwards was directed to visit the United States with a view to ascertain how far and in what, if any, respect American traffic methods could be advantageously introduced in British railway practice. As the outcome of his investigation, a series of extremely valuable reports on important subjects were prepared. Further promotion followed in October, 1909, when he became Assistant to the Superintendent of the Line, and in July, 1910, he was appointed Outdoor Goods Manager for the southern half of the system. Sir Herbert Walker was closely concerned in the working absorption by the London and North Western of the North London Railway, in December, 1908, and it fell to his lot to reorganise the whole of the arrangements of the latter. He had also much to do with the Conciliation scheme of 1907, and was generally so well informed concerning the working of the scheme on the London and North Western system, that he came to be regarded as its chief spokesman when important matters have called for outside inquiry. He commenced the duties of his present position, succeeding Sir Charles Owens, on January 1st, 1912.

Since his accession to the chief administrative post at Waterloo many changes have been made on the London and South Western Railway, and it is an open secret that the electrification scheme now in progress is largely attributable to Sir Herbert's interest and support. His appointment as acting Chairman of the Railway Executive Committee, by whom most of the railways in England, Scotland and Wales have been administered since the outbreak of war is of itself a tribute to his organising ability, and the knighthood conferred upon him on January 1st of this year, constitutes an acknowledgment of the debt which the nation as a whole owes to the services of the members of the Committee as represented by Sir Herbert Ashcombe Walker.



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EXTERIOR OF SHREWSBURY (JOINT) PASSENGER STATION.

The Progress of the Great Western Railway from Oxford to the Mersey. [No. II.]

By HERBERT RAKE.

E. THE SHREWSBURY AND BIRMINGHAM RAILWAY.—*Continued.*

AT the Shrewsbury end, the Shrewsbury and Chester, Shropshire Union, and Shrewsbury and Hereford Railways were all to have an interest in the station at that place, which would allow of an access to Mid and South Wales. The Shrewsbury and Wellington section of the line was to be jointly constructed and be the joint property of the Shrewsbury and Birmingham and the Shropshire Union Railway and Canal Companies, the latter to have the power to run over the line between Wellington and Wolverhampton and to use the former company's station at Wolverhampton on terms to be arranged.

The first general meeting of the company was held on September 19th, 1846, when the Directors stated they had obtained possession of the land between Wellington and Oakengates, and the contract for this portion was first undertaken, as it was the heaviest portion of the line and included the Oakengates tunnel. The second general meeting was held on March 26th, 1847, when the report stated that the contracts for the section of line between Shrewsbury and Wellington had been let, and had also been arranged for as between Wellington and Wolverhampton.

At the half yearly meeting, held at Wolverhampton on August 12th, 1847, it was announced that an Act had been obtained during that year (10 and 11 Vict. Cap. 80) authorising branches to Madeley and from Coalbrookdale to Ironbridge, on the River Severn, and to raise an additional share capital of £155,000 and loans to the extent of £52,000. On July 13th, 1849, a special meeting was held for the purpose of approving of a Bill to enable the Company to abandon certain portions of the Coalbrookdale branch lines and to authorise one line from a junction between Shifnal and Wellington. In 1847 (10 and 11 Vict. Cap. 188) powers were also obtained to run over a proposed branch of the London and North Western Railway from Wolverhampton to Portobello Junction, which, by means of the South Staffordshire (now London and North Western Railway) and North Staffordshire Railways, would complete the chain of communication between Shrewsbury and the eastern districts of England. This branch was, however, abandoned at the time, although afterwards constructed, partly in 1865 and partly in 1877.

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By an Act of 1847 (10 and 11 Vict. Cap. 121) the Shropshire Union Railway and Canal Company was to be leased to the London and North Western Railway under certain conditions, and in order to obtain the necessary protection for through traffic from Shrewsbury and North Wales to the Metropolis, the Shrewsbury and Birmingham Company lodged a petition in Parliament against the lease, with the result that an agreement was entered into between the Shrewsbury and Birmingham and London and North Western Railways whereby the receipts for all through traffic should be shared. The Shrewsbury and Birmingham Company, however, felt that the London and North Western Company had "pinned" them down at both ends, and therefore a closer working arrangement with the Great Western Company was advocated.

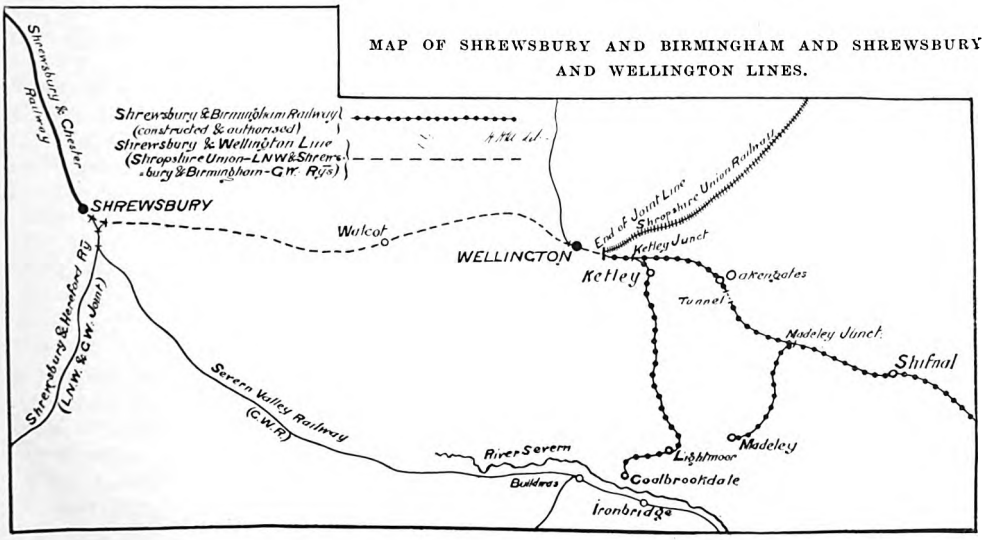
The tunnel between Oakengates and Shifnal being through solid rock, although only about 400 yards long, presented such difficulties that it appeared at one time likely to delay the opening of the line. It was constructed to sufficient breadth to admit of the broad gauge being laid down. The bridges and viaducts on the line were also made of a like width. The section between Shrewsbury and Wellington, which, as before stated, was constructed jointly with the Shropshire Union Railway, was opened on June 1st, 1849.

At the half yearly meeting, held on August 30th, 1849, it was stated that "the best understanding existed with the Shrewsbury and Chester and Chester and Birkenhead lines and with the expected improvements in the navigation of the River Dee, a large portion of the Irish goods traffic to Wolverhampton and Birmingham may be confidently expected." Traffic could never be fully developed, however, until the opening of the Stour Valley route, so as to afford uninterrupted communication between Shrewsbury and Birmingham. The Shropshire Union Railway could only be regarded as a competitive line, as it had by this time been leased by the London and North Western Company.

The main line from Shrewsbury to a temporary station at Wolverhampton, a distance of 30 miles, was opened on November 12th, 1849. The permanent structure (High Level station) was to be erected at the joint expense of the Shrewsbury and Birmingham and Birmingham, Wolverhampton and Stour Valley Railways, and the Shrewsbury Company acquired running powers over the Stour Valley line and commenced running their trains into New Street, Birmingham, on February 4th, 1854. When, however, the Dudley and Wolverhampton line was opened in November of the same year these powers were no longer necessary.

By agreement, a joint fund was to be provided out of the receipts from the through traffic between or beyond Wellington and Rugby, of both the Shropshire Union and the Shrewsbury and Birmingham Railways, as these were the two points where the Shrewsbury and London traffic diverged and again met. By the same agreement the London and North Western Railway engaged not to compete for the traffic of the Shrewsbury Company between Shrewsbury

MAP OF SHREWSBURY AND BIRMINGHAM AND SHREWSBURY AND WELLINGTON LINES.



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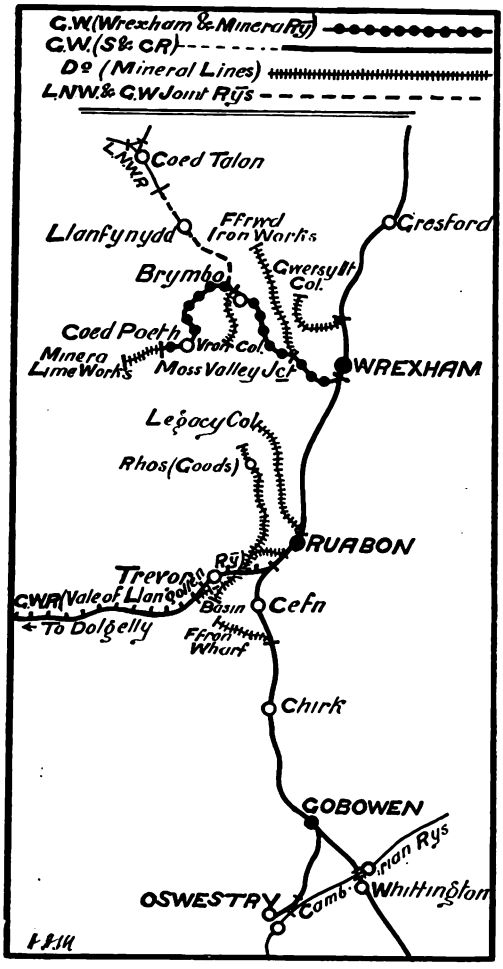

SHREWSBURY AND CHESTER RAILWAY.
(Oswestry and Wrexham Section.)

and Wolverhampton or Birmingham by way of Stafford or otherwise.

The Shropshire Union Company, which had opened their line between Shrewsbury and Stafford in the summer of 1849, appears to have had the effect, on the opening of the line between Shrewsbury and Birmingham, of reducing the fares from Shrewsbury *viâ* Stafford to Birmingham, the earlier route being 14 miles longer. Consequently, the Shrewsbury and Birmingham Railway, in conjunction with the Shrewsbury and Chester Company, made arrangements to obtain a portion of the Liverpool traffic *viâ* the Chester and Birkenhead Railway.

The London and North Western and Shropshire Union Companies, in retaliation, commenced a competition for the Shrewsbury traffic to Wolverhampton *viâ* Stafford at a fare less than half that from Shrewsbury to Stafford. The Shrewsbury and Birmingham Company then required the agreement with the Shropshire Union Company before referred to to be carried out, but were informed that in consequence of the competition set up for the Liverpool traffic the London and North Western Company held themselves free from all anterior arrangements.

It therefore became necessary to apply for an injunction to prevent that Company and the Shropshire Union Company from competing for the proper traffic of the Shrewsbury and Birmingham Railway and for enforcing the obligations of the agreement. The London and North Western Company practically claimed the whole of the Liverpool traffic, but the Shrewsbury route being shown to be only three miles longer it was held that the Shrewsbury Company was acting within its rights, and in June, 1850, the injunction was granted.

A further reduction of fares by the Shropshire Union Company between Shrewsbury and Wellington followed. That portion of the line was free of tolls to or by either Company, but was subject to the maintenance of the public way. This reduction forced the Shrewsbury and Birmingham Company to seek the intervention of the Railway Commissioners. The London and North Western Company then effected an agreement with the Chester and Birkenhead Railway whereby it was sought to exclude the joint traffic of the Shrewsbury and Birmingham and Shrewsbury and Chester Railways.

Owing to the delay in completing the Stour Valley line, which had been leased by the London and North Western Company, the Shrewsbury Company decided, as regards their Birmingham traffic, to avail themselves of the Birmingham Canal at Victoria Basin and the wharf which adjoined the temporary station at Wolverhampton before mentioned, but on commencing to transfer goods and minerals from the trucks to the barges alongside, the men employed were opposed by physical force on the part of an assembled body of navvies in the service of the contractors for the Stour Valley line, and this led to a serious riot and the calling out of the military.

At the half-yearly meeting held in the autumn of 1851 the chairman stated that the third class passenger fares between Shrewsbury and Wellington, a distance of 11 miles, as charged by the London and North Western Company was then one

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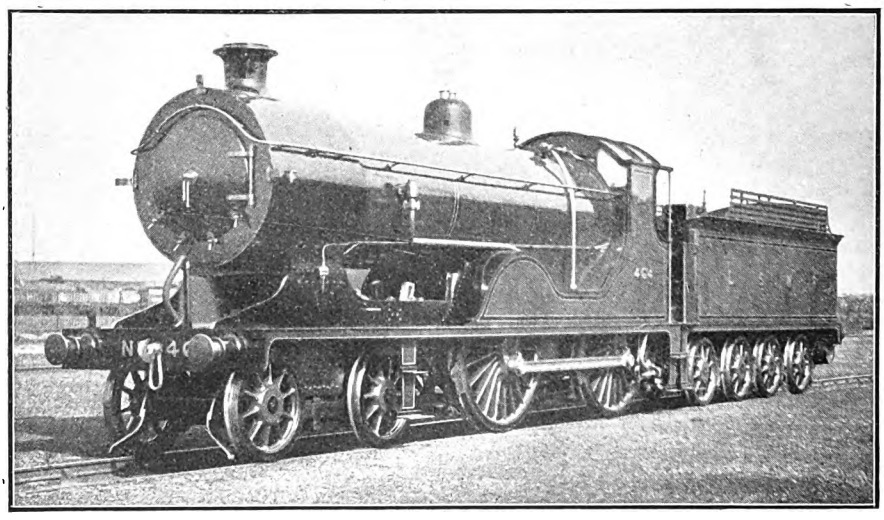
to both policies, and who favoured keeping aloof from either trunk line and taking traffic from both. A following general meeting held at Wolverhampton was consequently of a very stormy character. The chairman asserted that an alliance with the Great Western Company would open up a direct route to them from Birmingham *viâ* Reading to Dover and from Reading *viâ* Basingstoke to Southampton and Portsmouth, far beyond the limits of the London and North Western system.

The validity of the contract with the Great Western Company and also the proposed working arrangement with the London and North Western Company, which, it had been stated, did not require an Act of Parliament, being also called in question, the directors agreed to refer both to the judgment of "Counsel of eminence" and at the adjourned meeting their finding was laid before the shareholders, the concluding paragraph of which stated, "We are of opinion that neither agreement is legal nor can it be enforced by one party as against the other and it should not be carried out except with a unanimous consent."

This judgment was not approved of by the London and North Western faction, nor at first sight did it commend itself to their opponents, but "Philosophers who find a doctrine to their mind in every part to make it fit will force all nature to submit," and the Great Western faction perceived that if they could steal a march and secure practical unanimity by enlisting the independent party in their favour, on undertaking to promote a bill for carrying out the Great Western alliance in a legal manner, the residuum of opposition would be forced to submit *en bloc*. They therefore denounced the offer of the London and North Western Company to guarantee 4 per cent. as "a delusion, a snare and a fraud" in the absence of an Act of Parliament to authorise the lease.

(*To be continued.*)

LOCOMOTIVE CONVERSION ON THE LONDON AND SOUTH WESTERN RAILWAY.



One of the late Mr. Dugald Drummond's large 4–4–0 engines of the 463 class has been fitted by Mr. R. W. Urie with the "Eastleigh" superheater, and by his courtesy an illustration is now reproduced of No. 464 as thus altered. The changes apply mainly to the smokebox, which is now of extended type to receive the superheater. The firebox water tubes have also been removed.

Four engines of this class are being dealt with in this way, and others will receive similar attention in due course.

As converted the boiler now provides heating surface distributed as follows:—

Small tubes, $1\frac{3}{4}$ in. diam. ..	782·5	sq. ft.
Large tubes, $5\frac{1}{4}$ in. diam. ..	357	,,
Firebox	144·5	,,
Total water surface ..	1,284	,,
Superheater	231	,,
Total	1,515	,,

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Locomotive and Train Working in the Latter Part of the 19th Century.

THE GREAT NORTHERN RAILWAY. [No. II.]

By E. L. AHRONS, M.I.Mech.E., M.Inst.Loco.Eng.

THE Manchester train services of the Great Northern Railway call for no comment until the year 1883, when in conjunction with the then Manchester, Sheffield and Lincolnshire Railway two special expresses were put on with stops at Grantham and Sheffield only. As the Manchester, Sheffield and Lincolnshire engines worked the trains north of Grantham, the London-Grantham runs are the only portions to be considered in connection with the Great Northern Railway. The two down trains were booked to cover the 105¼ miles in 126 min., but the up trains were allowed only 124 min. Within a year or two the timing was accelerated to 117 min. for the up and 119 min. for the down trains. These trains were extremely light, averaging 90 to 100 tons only, a load which included a through Great Northern coach for Bradford (Lancashire and Yorkshire Railway), for these fast special expresses of the King's Cross-Manchester service provided an excellent alternative route to Bradford *viâ* Penistone and Huddersfield by means of two through vehicles in each direction daily.

Below is given an excellent sample of a performance of an 8 ft. single on one of the up Manchester expresses in 1886. These speeds were, of course, frequently beaten during the 1888 and 1895 Scotch racing days, but I was not fortunate enough to be present personally on those stirring occasions. But this run is given as a good example of an everyday Great Northern performance of that period.

ENGINE No. 773. 8 FT. SINGLE. 18 IN. BY 28 IN.
LOAD: 6 COACHES, ABOUT 90 TONS.

			H. M. S.	M.P.H.
Grantham (due 4.17 p.m.)	dep.		4.17.20	—
Post 104	pass		4.20.38	—
„ 101	„		4.24.57	—
„ 100	„		4.26.19	43·9
„ 99	„		4.27.30	50·7
„ 98	„		4.28.30	60
„ 97	„		4.29.26	64·3
„ 96	„		4.30.19	67·9
„ 95	„		4.31.11	69·2
„ 94	„		4.32. 3	69·2
„ 93	„		4.32.53	72
„ 92	„		4.32.42	73·5
„ 91	„		4.34.30	75
„ 90	„		4.35.18	75
„ 89	„		4.36. 8	72
„ 88	„		4.36.58	72
„ 87	„		4.37.48	72
„ 86	„		4.38.41	67·9
„ 85	„		4.39.33	69·2
„ 84	„		4.40.26	67·9
„ 83	„		4.41.22	64·3
„ 82	„		4.42.18	64·3
„ 81	„		4.43.14	64·3
„ 80	„		4.44.11	63·2
„ 79	„		4.45. 9	62·1
„ 78	„		4.46.11	58·1
„ 77	„		4.47.15	56·2
Peterborough	„		4.48.23	—
Post 75	„		4.50.38	—
„ 74	„		4.51.58	45
„ 73	„		4.53. 8	51·4
Post 72	pass		4.54.13	55·4
„ 71	„		4.55.10	63·2
„ 70	„		4.56. 6	64·3
„ 69	„		4.57. 3	63·2
„ 68	„		4.58. 1	62·1
„ 67	„		4.58.58	63·2
„ 66	„		5. 0. 0	58·1
„ 65	„		5. 1. 7	53·7
„ 64	„		5. 2.16	52·2
„ 63	„		5. 3.30	48·6
„ 62	„		5. 4.42	50
„ 61	„		5. 5.48	54·5
„ 60	„		5. 6.46	62·1
„ 59	„		5. 7.41	65·5
„ 58	„		5. 8.36	65·5
„ 57	„		5. 9.30	66·6
„ 56	„		5.10.26	64·3
„ 55	„		5.11.23	63·2
„ 54	„		5.12.21	62·1
„ 53	„		5.13.26	55·4
„ 52	„		5.14.31	55·4
„ 51	„		5.15.38	53·7
„ 50	„		5.16.41	57·1
„ 49	„		5.17.45	56·2
„ 48	„		5.18.44	61
„ 47	„		5.19.43	61
„ 46	„		5.20.43	60
„ 45	„		5.21.45	58·1
„ 44	„		5.22.50	55·4
„ 42	„		5.25. 0	55·4
„ 40	„		5.27. 8	56·2
„ 39	„		5.28.16	52·9
„ 38	„		5.29.28	50

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		H. M. S.	M.P.H.
Post 37	.. .. pass	5.30.34	54·5
„ 35	.. .. „	5.32.44	55·4
„ 34	.. .. „	5.33.50	54·5
„ 33	.. .. „	5.35. 3	49·3
Hitchin	.. .. „	5.36.25	—
Post 31	.. .. „	5.37.41	45·6
„ 30	.. .. „	5.39. 2	44·4
„ 29	.. .. „	5.40.26	42·8
„ 28	.. .. „	5.41.48	43·9
„ 27	.. .. „	5.43. 0	50
„ 26	.. .. „	5.44. 7	53·7
„ 25	.. .. „	5.45.18	50·7
„ 24	.. .. „	5.46.30	50
„ 22	.. .. „	5.48.36	57·1
„ 21	.. .. „	5.49.37	59
„ 20	.. .. „	5.50.37	60
„ 19	.. .. „	5.51.31	66·7
„ 18	.. .. „	5.52.26	65·5
„ 17	.. .. „	5.53.25	61
„ 16	.. .. „	5.54.30	55·4
„ 15	.. .. „	5.55.37	53·7
„ 14	.. .. „	5.56.44	53·7
„ 13	.. .. „	5.57.53	52·2
„ 11	.. .. „	6. 0. 5	57·1
„ 10	.. .. „	6. 1. 6	59
„ 9	.. .. „	6. 2. 3	63·2
„ 8	.. .. „	6. 3. 0	63·2
„ 7	.. .. „	6. 4. 1	59
„ 6*	.. .. „	6. 5. 8	53·7
„ 5	.. .. „	6. 6.10	58·1
„ 4	.. .. „	6. 7.10	60
Finsbury Park..	.. „	6. 8.46	—
King's Cross (due 6.15)	arr.	6.13.20	—

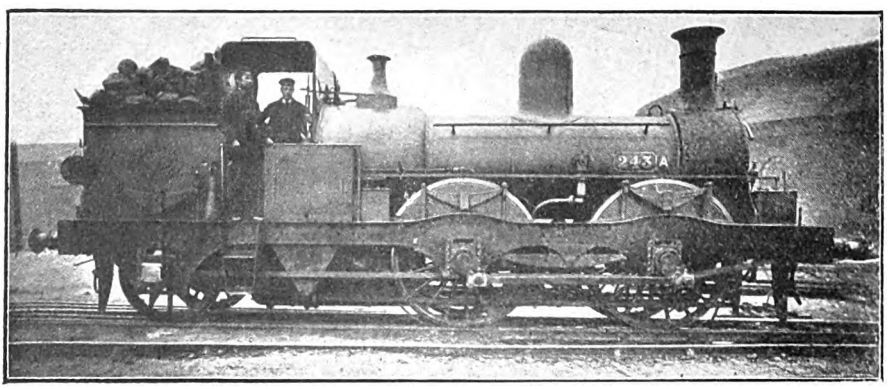
The 90 mile stretch from post 98 to post 8 was covered in 94½ min. exactly, but on this occasion the train was well in front of time, and after passing Peterborough the speed fell off to that which was sufficient to maintain scheduled time. No. 773 was said to have been one of the best of the eight feet singles, and I was told had several excellent performances to her credit.

The King's Cross and Grantham run of 105¼ miles was for very many years the only 100-mile run in the country. In July, 1880 there were five down and three up trains which performed it, but that month was a high-water mark of Great Northern speed, as the short-lived Leeds special expresses were then running.

* Signal check between 7th and 6th posts.

In one respect I was singularly unfortunate in my Great Northern experiences. During the period 1885 to 1892, I never had a run behind one of the 7 ft. 6 in. singles of the 229 class. It was only in the summer months of the years 1896–7–8, that I made my "travelling" acquaintance with these engines, and then always on the 5.45 p.m. Leeds "Diner" from King's Cross. This, probably the heaviest down train of the day, was always run, within my experience of some half-a-dozen journeys with it, by a "single" as far as Grantham, either an 8 ft. or a 230 class. I regret that I have mislaid my rough note books with the recorded runs, which I did not take the trouble to copy out. The load was generally 16 or 17 coaches—say 250 to 270 tons, and the way the singles, unaided by any pilot except the initial pusher out of King's Cross, dealt with the trains up to Potters Bar was wonderful. One could prove mathematically that they never could do it, but there must have been some flaw in the premises, for they nearly always did do it.

This again reminds me of the coupled engines. This particular train on several occasions on which I travelled by it, was worked north of Grantham by a coupled engine. I remember Nos. 702 and 715, Stirling 2–4–0's, on two occasions, and No. 400, Mr. Ivatt's first 4–4–0 bogie engine (with small boiler) on another. But, although the road north of Grantham is much easier than that south of it, the coupled engines made "many bones" of their work. They were thumped along, accompanied by the clattering of cinders on the roofs of the



STURROCK'S METROPOLITAN TANK ENGINE, NO. 243A, AS RUNNING UNTIL 1878–1880.

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Photo] [*P. W. Pilcher.*

NO. 233, STIRLING 7 FT. 7½ IN. SINGLE, REBUILT WITH DOMED BOILER, ON EAST LINCOLNSHIRE TRAIN NEAR BOSTON.

principally in the absence of the former brass-domed tank engines, the 241 and 270 class of Sturrock's design as well as the light green North London engines by Mr. Adams. The constant flitting to and fro of the polished brass chimney caps and domes gave Finsbury Park a somewhat brighter appearance than it has now.

The Nottingham and Grantham line and the East Lincolnshire line from Peterborough to Grimsby may be described as the "last ditches" of the single-wheeled express engines, to which each generation in turn has been handed over from the main line.

When I remember these lines first, the 6 ft. and 6 ft. 6 in. Sturrock rebuilds were doing the greater part of the work on them, and on the Nottingham line two rebuilt "Jenny Linds," Nos. 201 and 202 were greatly in evidence. These had lost their E. B. Wilson features, and had the appearance of Mr. Stirling's No. 4 class of 7 ft. singles in miniature. As the above engines disappeared, it became the turn of the old 230 class 7 ft. Sturrock's to take their places. Of these No. 231A lasted on this road until 1898, and No. 233A till 1900. No. 240A was scrapped in 1899, and together with No. 229A had for many years maintained the Great Northern reputation on the London-Cambridge line for fast running.

On the East Lincolnshire the places of the 6 ft. 6 in. Sturrock's (old No. 207, etc.), had been taken by Nos. 264 to 269, the six 7 ft. singles which had been rebuilt and converted from coupled engines, and for a long time they did the bulk of the work between Peterborough and Grimsby—perhaps the straightest and most level line in the Kingdom. These engines were broken up between 1898 and 1901, and then came the turn of Mr. Stirling's 7 ft. singles—No. 4 class. These, however, were distributed all over the system. Several of them ran between Grantham and Lincoln for a long time. The 7 ft. 6 in. engine No. 92 was broken up in 1902, but the others lasted longer. The actual fate of two of them was somewhat unusual. These were Nos. 215 and 55, both stabled at Colwick (Nottingham). No. 215 must have remained in the shed for nearly two years without "turning a wheel," not because there was any defect in her, for she could hold her own with any 2–4–0 coupled engine then working between Nottingham and Grantham, but it seemed that the dictum had gone forth that the day of the "single wheeler" was over, and it became the proper thing to use the coupled engines (some of which were not within two coaches of No. 215) in preference. Then she was moved to Lincolnshire, and did nothing as a spare engine, except that whenever any other engine had a part or a fitting missing, somebody was sent along to No. 215 to take the corresponding one off her. This became so habitual that in a short time there was only about half of No. 215 left, and as nobody knew where the other half had gone, the locomotive department compromised matters by scrapping the balance. There are, or were bits of her, after the manner of what the American tourist calls "souvenirs," running on other engines all over the Great Northern system. Most engines in the Nottinghamshire and Lincolnshire districts possessed something belonging to her.

Then there was No. 55. My last journey behind her was in December, 1902, but in August, 1903, she emerged from Doncaster to the astonishment of everybody, in the full glory of an Ivatt domed boiler. In fact, the running department seemed to be so overcome that it forgot to use her, and I should think the number of miles she ran with the new boiler could have been run by any ordinary engine well within a month's work. I believe that an attempt was made to utilise her like No. 215—as a sort of supernumerary stores department. Anyhow within a very few months of the new boiler she disappeared to Doncaster—

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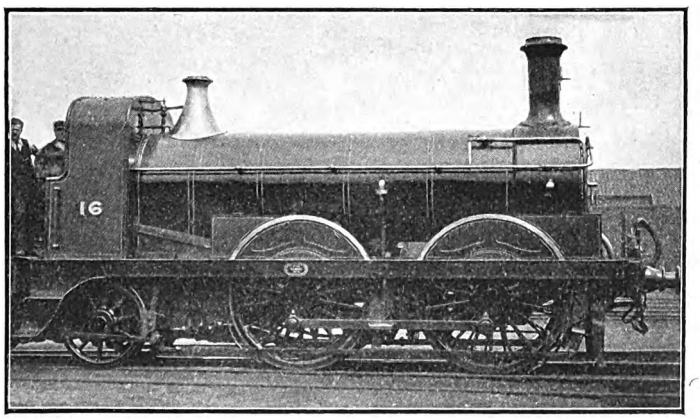
that bourne whence the "single" now hardly ever returns.

Then came the turn of those main line giants of former years—the "eight-footers." They held their own for the first few years of Mr. Ivatt's superintendency, though supplemented from 1898 onwards with large coupled engines for the heaviest trains. But in September, 1899, No. 60 disappeared. She was the first to go, and I happened to visit Doncaster at the time, and saw the funeral. I have seen a good many old racers scrapped, but I think none gave me a greater pang than did No. 60 when she went. It truly portended what was to come later, when more followed, and finally in 1903–4, shortly after the appearance of the large Atlantics of the 251 class, there was a general *sauve qui peut* of the survivors from the main line to the Lincolnshire and Cambridge branches. Nos. 34 and 221 (with domes) were transplanted to Hitchin for the latter branch. Nos. 22, 93 and 95 (also with domes) ran frequently between Grantham, Nottingham and Derby. Some worked between Grantham and Lincoln, but the bulk of the remaining "eight-footers" found refuge at Peterborough and Boston, where they had a sort of "workhouse" existence on the East Lincolnshire section. Apart from the larger engines Nos. 1003–1008, which have not been mentioned, the last survivors of the old Brigade were Nos. 668 and 1001 without domes, and Nos. 776 and 95 with domes, but all these were scrapped in 1912–13. Of the larger 1003 class with 19½ in. cylinders, which were built in 1894–5, there were recently* four at work. Of these, No. 1006 jogged along daily with a three coach local train of 40 to 45 tons between Grantham and Leicester and also between Leicester and Peterborough (*viâ* Seaton Junction), work at which any former self-respecting London 'bus-horse would almost have turned up its nose. No. 1007 (with dome) was alternately employed on the same turns with No. 1006, but this engine has since been scrapped (1913). Nos. 1003 and 1004 (Peterborough and Boston) and No. 1008 at Louth (or recently there) together with 1006 are or were the sole survivors of that magnificent brigade of 53 engines that was the one time wonder of the locomotive world. *Sic transit gloria locomotivæ!* I have omitted No. 1 to which they did something in the taxidermist line, by removing her inside, with a view to preserving her in a glass case at King's Cross station, after appearing at one of the White City Exhibitions alongside No. 1442, then the newest large "Atlantic." So far, I believe, the glass case has materialised only as a tarpaulin in the London engine shed.

In like manner the stud of 23 7 ft. 6 in. singles has also gone, though two years ago (1912), there were three domeless engines and eleven with domes at work. Of these Nos. 235 and 240 were at Lincoln, Nos. 233, 234, 237, 874 and 875 at Boston and Peterborough for service on the East Lincolnshire line. Nos. 872, 873, 876, 877 and 879 were, I believe, at London and Hitchin, and two of the London engines of the class, No. 872, and on one or two occasions 876, had the honour of performing the last regular main line express work on the Great Northern done by singles, when in 1912–3 they took their turns on the special afternoon Bradford expresses (put on to compete with the Midland and Lancashire and Yorkshire joint route), comparatively light trains which had a very fast non-stop timing between King's Cross and Doncaster.

Nos. 871 and 880 were quartered at Grantham and from 1908 were generally to be found on the 5.45 p.m. express from Grantham to Nottingham and Burton, which was booked to run to Netherfield—



STIRLING 0-4-2 MIXED TRAFFIC LOCOMOTIVE, NO. 16.

* May, 1914.

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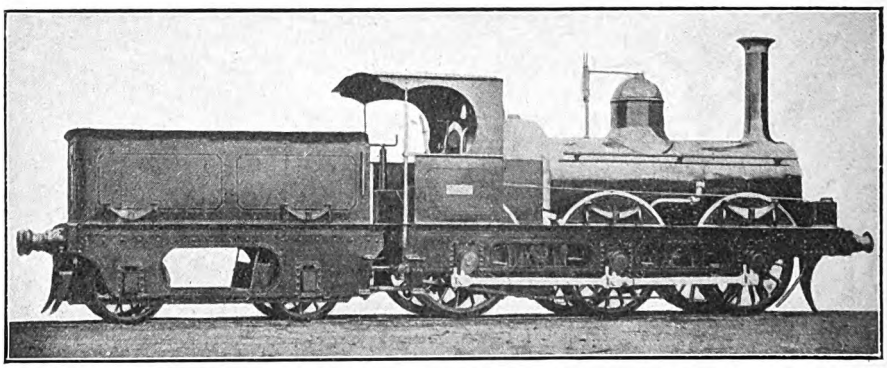
19¾ miles—at 49½ miles per hour. They did excellent running on this, as I can testify from frequent journeys; in fact they were almost invariably one minute better to Radcliffe than the 2–4–0 engines which succeeded them early in 1912. The reason for this change was that something happened. The 5.45 engine goes through to Burton, and on one foggy slippery evening one of the "singles" stuck in the Great Central tunnel between Nottingham (Victoria) and Carrington, and caused a few minutes' delay. The result was an official enquiry and reams of official correspondence, and eventually Nos. 871 and 880 had to retire upon the three-coach slow trains of the Grantham-Leicester service, and shortly afterwards they were scrapped. One thing was apparently forgotten, *viz.*, that there had also been instances of the coupled engines "sticking" in the same tunnel.

In 1913 there was a wholesale battue at Doncaster of the remainder of the class. I doubt whether any of them have survived.* But why were not the best of them, with the large Ivatt domed boilers, retained to run upon the East Lincolnshire line, a road 78½ miles long eminently suitable for "singles"?

Before entering upon the West Riding portion of the Great Northern Railway, a few words may be added as to the goods train working from a locomotive standpoint. Mr. Patrick Stirling came to the Great Northern Railway in 1866 from the Glasgow and South Western, a railway which had almost invariably up to that time employed four-coupled engines for goods traffic. This bore fruit on the Great Northern, for throughout Mr. Stirling's chieftainship the fastest goods trains were generally worked by this type in preference to six-coupled engines. Generally speaking the 0–4–2 engines were employed, but very frequently as their number increased, the 2–4–0 engines were used. And on several occasions I have even seen the 8 ft. singles working goods traffic.

At York there were seven of the 0–4–2 engines of which No. 18, the first engine built by Mr. Stirling at Doncaster (in 1867) was one. Generally speaking the 0–4–2 "mixed traffics" became more and more used for passenger trains, until eventually they were looked upon as passenger engines, but No. 18 throughout a long career at York stuck faithfully to the fast goods trains. I used frequently to see her, but never once on a passenger train, though Nos. 593 and 594 of the same type worked the stopping trains between York and Doncaster *viâ* Knottingley. The London to Bradford wool train was always run from Peterborough by the New England 0–4–2 engines Nos. 85, 555, etc.



OLD LEEDS, BRADFORD AND HALIFAX RAILWAY GOODS ENGINE, BUILT BY HUDSWELL CLARKE & CO., OF LEEDS, 1863.

The final section of the Great Northern to be considered is that in the West Riding. Here the character of the railway changes entirely with the change in the features of the country. The green fields of the London to Doncaster section give way to the collieries, ironworks, and mills of the lines north and north-west of Wakefield. And the "single" express engines, which seemed eminently to harmonise with the former section, were replaced by the 0–4–2 "mixed traffics" or by tank engines, for no Great Northern "single" engine was ever known

* In December, 1914, there were no 7 ft. 6 in. singles and only two 8 ft. engines remaining, according to the official returns.

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to enter Bradford. The main line section from Doncaster to Leeds has already been mentioned and nothing further need be said about it.

There have been four possible routes for a Great Northern carriage from Bradford to London, all of which have been extensively used. They are :—

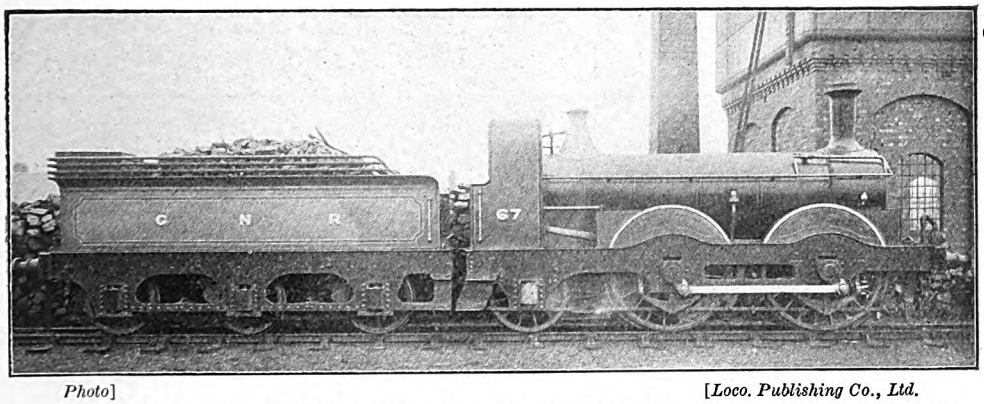
(*a*) Bradford to Wakefield *viâ* Morley and Ardsley where the main line from Leeds is joined.

(*b*) Ditto, *viâ* Dewsbury and Ossett. This line forms a loop from (*a*) which it leaves at Adwalton Junction, and joins the main line at Wrenthorpe Junction close to Wakefield.

(*c*) Bradford to Leeds direct *viâ* Stanningley.

Northern Bradford trains to the shorter route (*a*) by which they made the Bradford-Wakefield run without a stop.

Route (*c*) has always existed since the taking over of the "Leeds, Bradford and Halifax Railway" in the early 'sixties, but it is only within the last decade that it has become a recognised path for London expresses. In using it the Great Northern Railway may be said to be copying the Midland, and I believe the "dining car" is responsible for the innovation. The Bradford people felt that they were quite as good trenchermen as their Leeds rivals, but they strongly resented being turned out of the comfortable Leeds dining car at Wakefield. So the King's Cross authorities compromised matters by taking certain of the



Photo] [*Loco. Publishing Co., Ltd.*

NO. 67, ONE OF TWO 0-4-2 DOUBLE FRAMED ENGINES WITH 6 FT. COUPLED WHEELS, AND CYLINDERS 17½ IN. (AFTERWARDS 18 IN.) BY 24 IN.

(*d*) The old through coach route of the "'eighties" *viâ* Huddersfield and Sheffield to Retford.

Of the above (*d*) is absolutely defunct as far as the Great Northern is concerned, for it has been "taken over" by the Great Central. For a number of years there were four Great Northern through coaches per day over it, two each way. They joined the Manchester expresses at Sheffield and have already been mentioned.

(*a*) is the most usual route for Bradford-London trains, and nearly all the fast trains have been run over it. But in the late 'seventies route (*b*) *viâ* Dewsbury was frequently employed, as this passes through the more thickly populated district, and the trains could accommodate London passengers to and from Dewsbury, Batley and Ossett. The acceleration of the rival Midland Bradford expresses in the summer of 1880 had the effect of sending the Great

dining car trains into Leeds and attaching an engine to the rear of the train in order to convey the whole through to Bradford *viâ* Stanningley.

The West Riding branches radiating from Bradford may be described as a series of "White City" switchbacks on a large scale, but with this difference, that though there is a vast amount of switchback, there is no whiteness. Lest I should be held to be libelling the district, be it known that this reference extends only to the "Great Northern" side of Bradford. If a line be drawn through Leeds and Bradford due east and west, to the immediate north of that line there lies some of the finest country and scenery in the kingdom. But I am only now dealing with those portions which are served by the Great Northern Railway.

So much for the colour—now as to the switchback. From Wakefield there is a

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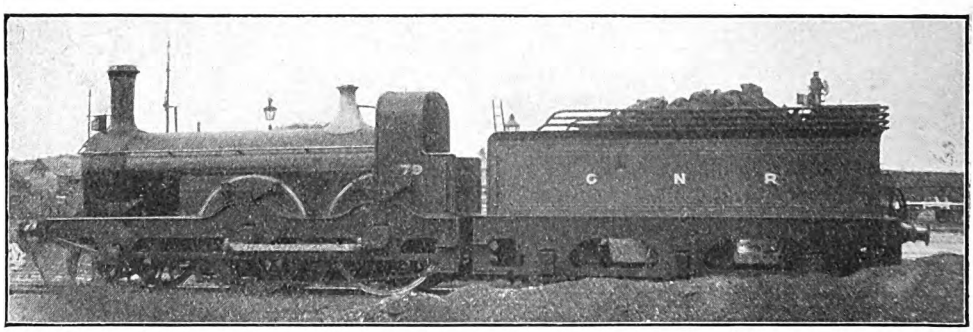
continuous rise of 1 in 100 to 1 in 122 to Ardsley for 5 miles, followed by another 8-mile rise of 1 in 70 to 1 in 132, with a final 4-mile descent into Bradford of which 2 miles are 1 in 50 to 1 in 60. The Leeds and Bradford line rises from Leeds for about seven miles mostly 1 in 100 to 1 in 146 to the tunnel near Laister Dyke (one mile near Leeds being 1 in 50), then from Laister Dyke it follows the same route with a fall of 1 in 50 to 1 in 60 into Bradford.

This accounts for the changed character of the locomotives, and the absence of "singles." Moreover, for very many years it also barred the Stirling 6 ft. 6 in. 2–4–0 engines. All the tender passenger engines, with one or two early exceptions, consisted of the 0–4–2 "mixed traffics," of which quite an army was quartered at Bradford shed. Almost all the tank engines of the Great Northern Railway which were not in London, were in this district. For very many years the only 2–4–0 engines which ran into Bradford were two of the Sturrock rebuilds, Nos. 87 and 88, and these were transferred to Nottingham prior to 1882. One other fine-looking machine was No. 67, a 0–4–2 double-framed engine with 6 ft. wheels, which did many years' service at Bradford on the London expresses to Wakefield. Two of Sturrock's rebuilt 0–4–2 goods engines, Nos. 113 and 114, with 5 ft. wheels and double frames, were generally on passenger trains at Bradford until 1879, when they went elsewhere. Other than the above, there were nothing else but Stirling's mixed traffics.

The first 2–4–0 6 ft. 7½ in. coupled engine which I ever saw there was No. 72, which worked a special in which the late King Edward (then Prince of Wales) travelled from Bradford in June, 1882. And in the 'nineties engines Nos. 290 and 299 made sporadic journeys from Leeds. After Mr. Ivatt took charge at Doncaster, he sent two new 4–4–0's, Nos. 1301 and 1302, to Bradford, and several of the Bradford-Leeds expresses began to appear with Stirling's 2–4–0 engines, which also ran some of the London trains between Bradford and Wakefield. But this was at a considerably later date, and brings me down to the end of the 19th century.

But the resemblance to a switchback holds good also with regard to the curves, which are numerous and severe. The Leeds to Bradford line is moderately straight as far as Hammerton St. Junction, about 1¼ miles from Bradford station, but both the Wakefield to Bradford routes and the Halifax lines *viâ* Queensbury wind in and out in the most bewildering manner.

Originally the Great Northern had its own station at Bradford, the present goods station. It was ¾ mile nearer to Leeds or London than the present terminus, and at a much higher level, so that a fall of 1 in 100 only for about 1¼ miles from Laister Dyke was necessary. But the long uphill approach from the centre of the town was such a source of annoyance to the townspeople that about 1870 the company constructed a sharply-curved *détour* through a cutting partly on a gradient of 1 in 50 to make a junction with the Lancashire and Yorkshire Railway at St. Dunstans, and since then the Great Northern has been a tenant of this company at Exchange station. This station is very different from what it was prior to 1885. Formerly it contained three long platform roads and one short bay, all of which, together with the roads from the Lancashire and Yorkshire Railway goods station, merged into one down and one up line through a tunnel immediately outside



Photo] [*Loco. Publishing Co., Ltd.*

NO. 79, ONE OF TWO 6 FT. 2–4–0 ENGINES AS REBUILT.

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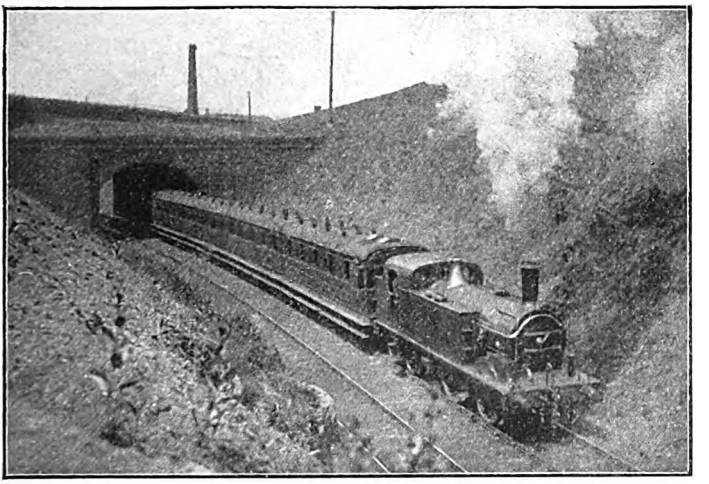

SHIPLEY-BRADFORD TRAIN IN THACKLEY CUTTING, ON A GRADE OF 1 IN 60.
Stirling 0–4–4 tank engine, No. 661.

the station. This tunnel was always known locally as the "bottle neck," and the chaos inside it, which ruled for several hours in the day, baffles description. However, this is another story, and as I hope to perpetrate some libellous (though true) particulars of the old Lancashire and Yorkshire Railway at a future date, I will leave it until then.

Returning to the curves on the West Riding lines, it was wonderful how the 0–4–2 engines, with their 5 ft. 6 in. front coupled wheels and no bogies, took them. I have frequently in former years stood at the Great Northern engine shed near Hammerton St. Junction and seen the fast trains come down the 1 in 50 curved incline by the sheds at a higher speed than appeared really safe, with all the flanges grinding, but they always got through safely. I never heard of one of them leaving the road with a train. This seems to bear out very strongly Mr. Stroudley's contention that as the greatest weight was at the leading end, an engine with large wheels coupled in front was safe. Moreover, Mr. Stroudley's engines never got the severe gruelling that the West Riding curves gave to Mr. Stirling's "mixed traffics."

These engines had one fault. The fireboxes were small, and the engines always appeared to be "pounding" away, with a stream of cinders and sparks issuing out of the chimney. However, they are disappearing fast. Out of about 140 of them, nearly two-thirds of the number have been scrapped, for at the end of December, 1914, only 49 were in service.

Ichabod! There is one glory that has departed from the West Riding. If the reader will trouble to consult a map, he will possibly find thereon a "city" called Pudsey. This place, which the natives thereof name "Poodsa," appears to be of some importance, for it gives its name to a county division which returns a representative to Westminster. Pudsey was once the proud possessor of a railway of its own, a branch from Stanningley, about one mile long, which was generally worked either by a 0–4–2 saddle tank, No. 631 or No. 632, or Sturrock's former Metropolitan tanks (rebuilt), Nos. 241A, 244A, and 246A. In the 'nineties a new loop line between Leeds and Bradford was made which left the original line at Bramley, passed through Pudsey and joined the Wakefield-Bradford line near Dudley Hill. After the opening of this road, the old branch from Stanningley disappeared from the time tables. The junction at the Pudsey end was taken out and the line was converted into wagon sidings. Passengers from Stanningley to Pudsey now walk if they are in a hurry, or go round by train *viâ* Bramley if they are not.

Finally, there is the Great Northern branch from Laister Dyke to Shipley (Windhill), which is really a Bradford outer circle railway. This terminates at Shipley in a fine downhill run of 1 in 60 for 2½ miles, with a dead end and a blank wall at the bottom. For a number of years, Stirling's 0–4–2 tanks with radial axle-boxes, Nos. 126 and 127, worked the branch, all the others of the class being at London. No. 127 was transferred to the Nottingham district in 1902, and finished her days more recently with a coat of black paint and the inscription "Loco. Colwick" in place of the original number.

But the record for the Shipley branch has been for many years held by a six-coupled goods saddle-tank engine, No. 601, which in 1883 (I think) started from Idle station with a goods train, got beyond the driver's control, charged violently down the 1 in 60, demolished the buffer stops at Shipley, and emerged breathless but triumphant on the

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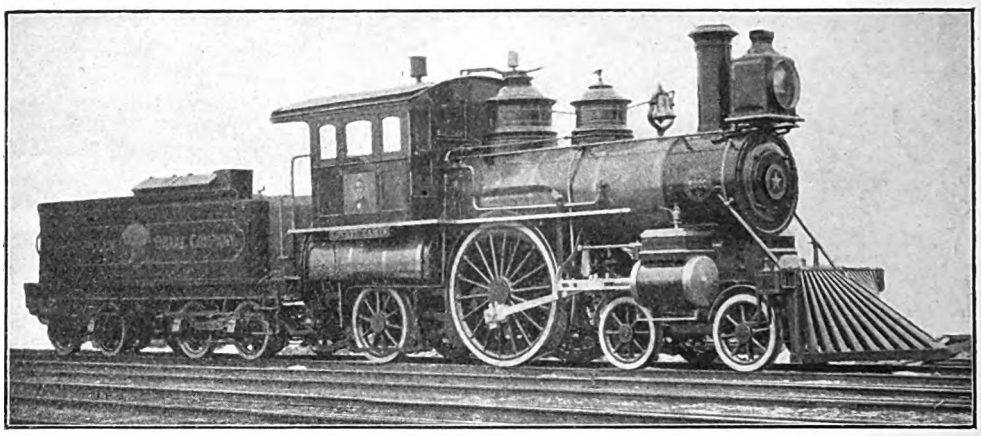

AMERICAN 4-2-2 EXPRESS LOCOMOTIVE, *Lovett Eames*, WHICH RAN SEVERAL TRIPS ON THE GREAT NORTHERN RAILWAY. (1882-3.)

wrong side of the blank wall, where it hung suspended in a vertical position some 10 ft. above the main road, where I saw it on my arrival on the scene shortly afterwards. Luckily, nobody was hurt.

At this dead end I must leave my Great Northern reminiscences, except that in closing this short account of the locomotive work on this railway it may be of some interest to mention the American express engine which ran a few trips on the line during 1882. The engine in question was one of the very few "single" express engines that the United States has produced. It was originally built for the Philadelphia and Reading R.R., by the Baldwin Locomotive Works in 1880, but for some financial reason the engine was left on the hands of the makers, who sold it to the Eames Vacuum Brake Co. This firm named the engine *Lovett Eames*, and shipped it in 1881 to this country as a travelling advertisement and practical demonstration of their form of brake. The single driving wheels were 6 ft. 6 in. diameter, the cylinders 18 in. diameter by 24 in. stroke, and the boiler pressure 135 lb. per sq. in. The weight on the driving wheels was 35,000 lb., but an arrangement was embodied in the engine whereby an additional 8,000–9,000 lb. could be added to the above by a separate steam cylinder which was connected to a cam. This cam moved so that the length of one arm of the compensating lever was increased and that of the other arm diminished, so that a portion of the weight on the trailing wheels was transferred to the driving wheels. It was put together at the Miles Platting, Manchester, Works of the Lancashire and Yorkshire Railway early in 1882, making its first trip on that line from Manchester to Leeds in March, 1882. The engine then remained at Leeds in the Great Northern shed for nearly four months, making a few odd journeys, and eventually came to London, being stabled at Wood Green. There it was broken up in the Spring of 1884 by a scrap merchant to whom it had been sold. When I saw it, it was standing outside Leeds engine shed near Holbeck. The bell was, and may still be, preserved at King's Cross running shed.

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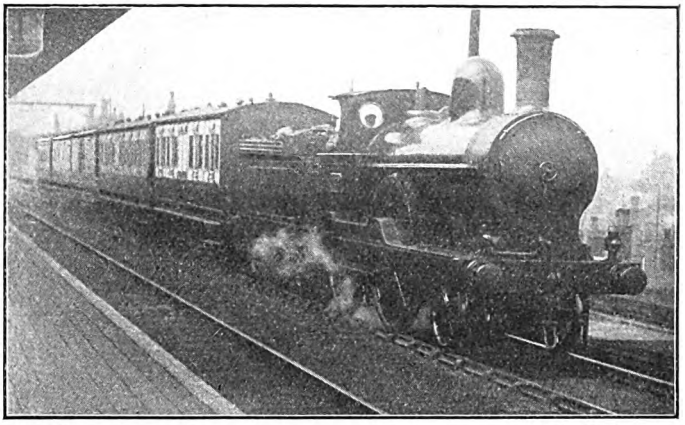
The Railways of South Staffordshire.

I.—LONDON & NORTH WESTERN RAILWAY LINES.

(*Continued.*)

By PHILIP F. GROVES.



Photo] [*Felix E. Jones.*

TRAIN IN DUDLEY PORT STATION.
2-4-0 locomotive No. 1177, *Princess Louise.*

RETURNING to Bescot Junction, the branch to Walsall from that station is 1½ miles long without an intermediate station. Most of the trains are through between Walsall and Birmingham, passengers for the Wood Green and Darlaston line having to change at Bescot, but in some cases it is the Walsall passengers who have to change. The make-up of the branch trains from Bescot to Walsall and *vice versâ*, which meet the through Wolverhampton and Birmingham trains at Bescot, is often rather peculiar, consisting, for example, of two small six-wheelers hauled by a large 4-6-0 or 0-8-0 goods locomotive, which is perhaps being sent to Walsall to take a train. Walsall has a locomotive depôt (No. 9) of its own.

At Pleck East Junction, between Bescot and Walsall, two further branches join the Bescot and Walsall section, all with junctions facing towards Walsall. There are thus three routes for trains entering Walsall station at its south end, (1) Birmingham, Bescot and Walsall; (2) Dudley, Wednesbury and Walsall; and (3) Wolverhampton, Darlaston and Walsall direct. The second of these uses a spur which curves round to meet the Bescot and Walsall line with a junction facing towards Bescot, thus forming yet another triangular junction. The curious point about this is that the spur is on the north side of the Wood Green and Wolverhampton line, which the Dudley branch crosses about ½-mile south of Pleck East Junction, so that trains from Wednesbury and Dudley to Bescot and Great Barr direction have to cross over the line they are destined for before actually running on to it. This is not, however, a flying junction as ordinarily understood. The curve is on a severe gradient, a bank engine being used for trains coming from Bescot to Wednesbury. Another line where a bank engine is in constant requisition is that between Great Barr and Perry Barr and Winson Green and Soho. The bank engine is kept at Perry Barr from 12 midnight to 6 p.m. daily, but when required for a train coming from the Walsall direction and not passing through Perry Barr, it is sent to the Great Barr end of the triangle to be attached to its train there. On this line the gradient is in places as steep as 1 in 56.

The third line at Pleck East Junction has one intermediate station, Pleck, and joins the Bescot, Wood Green and Wolverhampton line at Darlaston station. The train service between Wolverhampton and Walsall by this route is as follows:—(1) Wolverhampton to Walsall, 16 (all but one calling at Pleck); (2) Walsall to Wolverhampton, 17 (four not calling at Pleck). There are also two rail motor trips from Walsall to Darlaston and Willenhall only and back. All these trains perform the complete journey between Walsall and Wolverhampton, calling at Willenhall, Darlaston and, in most cases,

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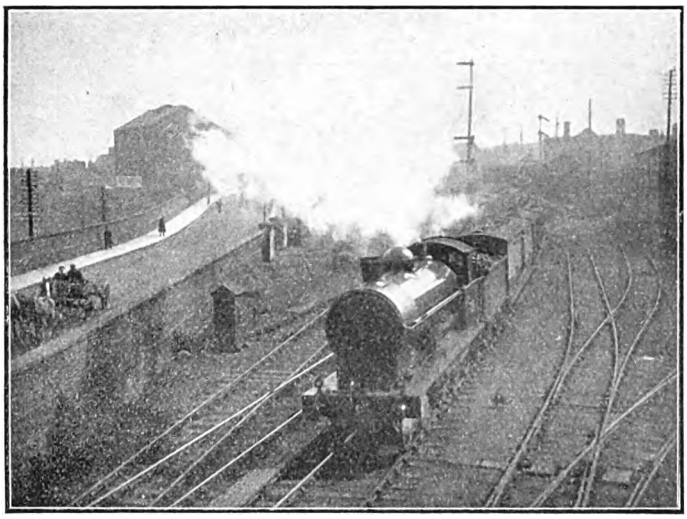

Photo] [*Felix E. Jones*

LLANDUDNO EXPRESS LEAVING SMETHWICK STATION.
4-6-0 superheater locomotive No. 479, *Thomas B. Macaulay.*

Pleck. These figures are inclusive of Midland trains which run *viâ* Darlaston.

The Midland line from Birmingham to Walsall and Wolverhampton involves reversing at Walsall. Consequently many, in fact most, of the Midland passenger trains between Birmingham and Wolverhampton travel between Wolverhampton and Walsall over the above-mentioned branch *viâ* Pleck, thus avoiding the reversal of the trains at Walsall, as this line leaves Walsall station at its south end. London and North Western trains, on the other hand, work most of the trips between Walsall and Wolverhampton over the Midland route, the relations between the two companies in this district being of a most intimate nature.

The Walsall and Dudley branch, whose relation to the other lines in the district was outlined above, leaves Pleck East Junction between the Pleck and Wolverhampton branch and the Bescot line, shortly after which it passes over the Bescot and Wolverhampton line between Bescot and Wood Green stations. Just before reaching the bridge the spur from Bescot joins the Dudley branch at Wednesbury Junction. Here are situated Crankhall Waterworks, having a siding connection, a large cemetery, and a sewage farm, there being also much of that muddy waste land which is so often to be seen in the Black Country.

Passing under the Great Western Birmingham, Wolverhampton, Shrewsbury, Chester and Birkenhead line near that company's Wednesbury station, Wednesbury (London and North Western Railway) station is reached. This is the junction for two lines, (1) the previously mentioned Princes End branch, and (2) a line used for goods traffic only, and known as the Darlaston branch, which runs to Darlaston station on the Wolverhampton, Bescot and Birmingham line. The line is 2½ miles long, is single line for about one-third of that distance, and serves nine of the great iron, steel and other works which abound in the district.

Leaving the Princes End branch to Dudley Port (High Level station) on the right, the Dudley line continues through Great Bridge station to Horsley Fields Junction box, 4 miles 50 chains from Walsall, where a Great Western branch from Swan Village to Dudley comes in on the left hand side.

The arrangements between the two railway companies here are somewhat peculiar, being as follows :—

Trains of the Great Western Railway exercise running powers over the Walsall and Dudley (London and North Western Railway) line from Horsley Fields Junction to Dudley Port, each company having a separate station at Great Bridge. Great Western trains all pass through Dudley Port station (Low Level) without stopping, and continue to exercise running powers over the London and North Western Railway as far as Dudley (London and North Western Railway) station. Here they run past the latter station, which is a terminus on a side line, coming to rest a few hundred yards south of it; after this they reverse and set back into a bay at their own station, which is not terminal, but a through station on the Oxford, Worcester, and Wolverhampton line, of which more anon. A considerable amount of goods and mineral traffic is exchanged between the two railways at Dudley, products from the many neighbouring chemical works forming no small part of this.

Dudley Port Low Level station is immediately beneath the High Level station there, the two being connected by a stairway. The Walsall and Dudley line passes beneath a

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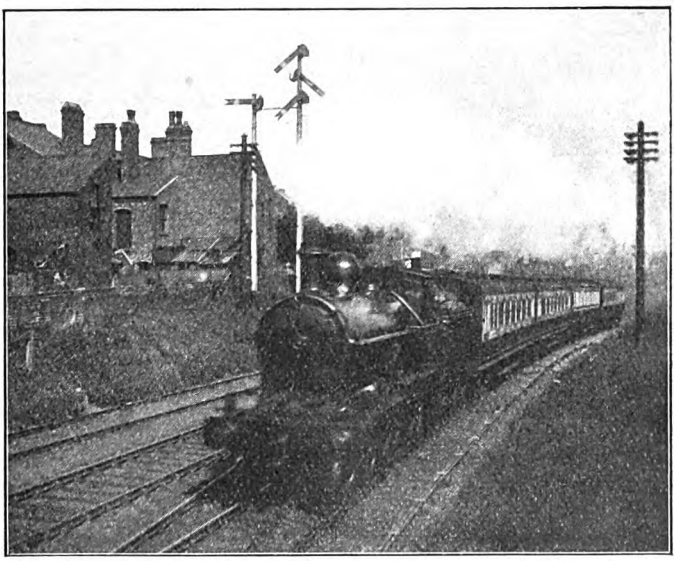
canal and the Wolverhampton and Birmingham line by a short tunnel at Dudley Port. There are 28 through trains daily from Birmingham to Walsall, *viâ* Soho Road, or Aston, and Bescot, four of these being non-stop. Two additional services are also provided by trains running through to Wolverhampton *viâ* Bescot, in which case a change at the latter junction is necessary. There is one through train daily from Stechford to Wolverhampton, and one in the reverse direction, travelling *viâ* the above-mentioned Aston-Stechford direct line. This leaves Stechford at 8 a.m., and reaches Wolverhampton (15¼ miles) at 8.35, calling at all stations except Witton, Newton Road, and Wood Green. A connection to Walsall is provided by the branch train from Bescot. The train in the opposite direction leaves Wolverhampton at 6.22 p.m., and reaches Stechford at 7.2 p.m. Trains leave Walsall at 6.55 and 11.20 a.m., reaching Stechford at 7.26 and 11.50 a.m. respectively. The latter calls everywhere to Stechford, and conveys through coaches, including a luncheon car, from Walsall to London, these being attached at Stechford to one of the slower London expresses from Birmingham, that leaving New Street at 11.45 a.m. The 6.55 a.m. from Walsall does not call at Newton Road.

From Walsall to Birmingham there are 24 through trains daily; *viâ* Bescot and Soho Road (8), or Bescot and Aston (16). Four other services are provided, two each requiring a change at Aston or Bescot. Walsall and Birmingham tickets are also available *viâ* Wednesbury and Dudley Port, and also by the Midland route by virtue of the usual inter-availability of ticket arrangements with that company; so it will be seen that the facilities provided for travel between the two places are very complete. The trains to Bescot and Birmingham, to Wednesbury and Dudley, and to Pleck and Wolverhampton leave Walsall station at its south end. The trains to four other lines, however, depart from and arrive at the north end of this station. The lines in question are :—(1) Cannock and Rugeley branch; (2) Lichfield and Derby branch; (3) Midland Railway to Birmingham; and (4) Midland Railway to Wolverhampton. These lines all run together as far as Ryecroft Junction, 50 chains north of Walsall, where they separate, fanwise, the Midland Wolverhampton line being to the left (facing north), then come the Cannock and Lichfield and Midland Birmingham branches, in that order from left to right. Walsall locomotive sheds (London and North Western Railway No. 9) are near Ryecroft Junction. The Midland Railway sheds, however, which stable about 14 engines, are near Pleck East Junction.

On the Cannock and Rugeley branch Birchills station is the first reached, 1⅝ miles from Walsall, but it is now only a rail-motor halt, as no ordinary trains call there, usual facilities being given by three rail-motor trips in each direction. Formerly, however, Birchills was served by most of the trains on the branch. This rail-motor makes three trips daily to Rugeley (Trent Valley station), two trips from Rugeley (T.V.) to Walsall, and one from Rugeley (Town) to Walsall, one to Willenhall, and one to Lichfield City and back. Continuing from Birchills, Thomas's siding is passed before reaching Bloxwich station (2¾ miles from Walsall). Eleven trains from Walsall call here daily,



Photo] [*Felix E. Jones.*

"CITY TO CITY" EXPRESS NEARING SMETHWICK.
Converted 4-4-0 locomotive No. 1918, *Renown.*

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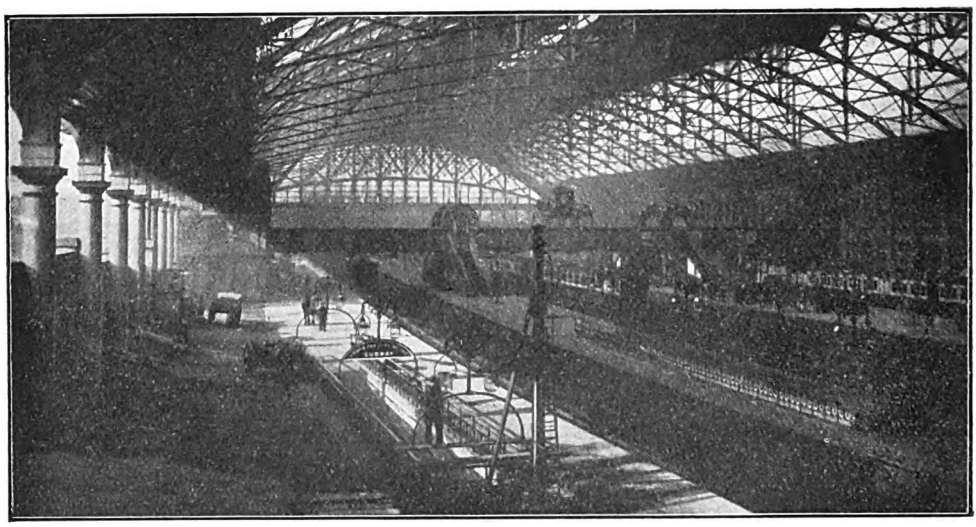
including motors and three other trains on certain weekdays, whilst another does so "to take up for Stafford and beyond on giving notice at the station." This train is one of those which run through from Walsall to Stafford *viâ* Rugeley, and some go through from Birmingham to the county town by this route. Thirteen trains to Walsall call at Bloxwich (including the motor cars) daily. The Walsall Corporation trams also run to Bloxwich and Birchills. Essington Farm Colliery Junction sidings, as they are officially styled, are 4¼ miles from Walsall by this line. A short branch runs from here to various canal wharves, brickworks, and collieries. This is, of course, not used for passenger traffic.

villages unprovided with railway facilities. There are two routes between Hednesford and Brownhills, the through fare by either route being 6d., so the result is a cheap, frequent, and extremely useful service.

Passing Rugeley Town station, Rugeley Trent Valley station is reached a mile further on, and 15 miles from Walsall. Here the London and North Western main line is joined. Some of the branch trains terminate here, but others go on to Colwich or Stafford. Wyrley, Cannock and Hednesford have 13 trains from Walsall daily, but there are two extra ones on Saturdays only. Rugeley Town has 12 trains daily, except Saturdays, when there are 13; this also applies to Rugeley (Trent Valley) station as far as branch trains



LONDON AND NORTH WESTERN RAILWAY PLATFORMS AT NEW STREET, BIRMINGHAM.

After passing further sidings, Landywood Halt, 5¾ miles from Walsall, is reached. Only the rail-motor cars call here. Wyrley and Cheslyn Hay station, till recently known as Wyrley and Church Bridge, and Cannock follow, 6½ and 8 miles from Walsall respectively. East Cannock Junction, about a mile from Cannock station, is the junction for what is known as the Norton branch, which runs to Brownhills, on the Lichfield and Derby branch, Brownhills being one of the stations thereon. The branch serves numerous collieries, and is only used for mineral and goods traffic.

Hednesford station (10 miles) is the terminus of a London and North Western Railway motor-omnibus service to Brownhills, which serves *en route* many mining

are concerned. In the reverse direction there are 10 branch trains from Rugeley (Trent Valley), 11 from Rugeley Town, and 13 from all other stations except Birchills and Landywood. The Sunday service comprises three trains from Walsall to Rugeley and two from Rugeley to Walsall, these calling everywhere except Birchills and Landywood, with a motor trip in each direction as far as Rugeley (Trent Valley), which calls everywhere.

Proceeding now to the Walsall, Lichfield, Burton-on-Trent, and Derby line, and commencing at the Ryecroft Junction end, it may be noted that this section conveys a considerable amount of mineral traffic from the Staffordshire coalfields to the Midland Railway, and the Eastern Counties *viâ*

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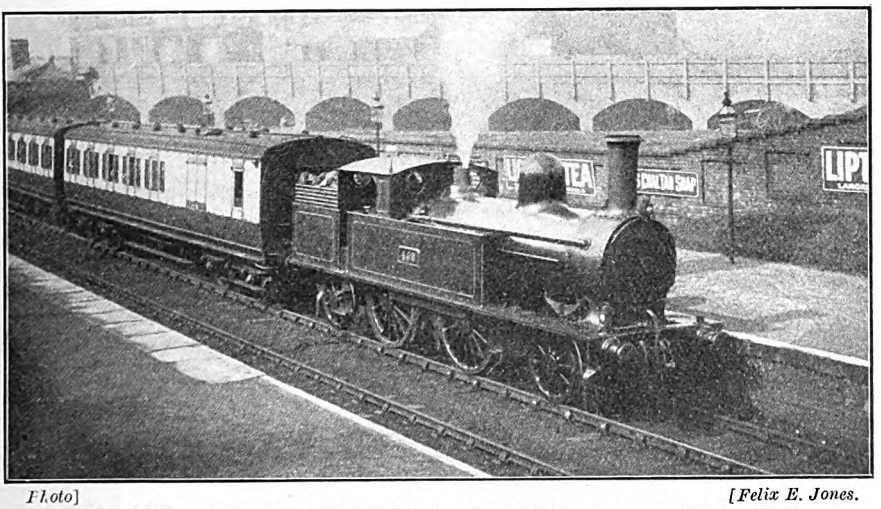
Wichnor Junction. Leighs Wood Junction, 2 miles 50 chains from Walsall station, is reached. A branch just short of 2 miles long runs from here to Aldridge Brickworks siding, serving three other brickworks and three collieries, at one of which there is also siding connection with the Midland Railway's Brownhills branch. Beyond Pelsall station is Norton Junction, 3¼ miles from Walsall, where the mineral branch to East Cannock Junction on the Walsall and Rugeley line joins the Walsall and Derby branch, with a junction facing towards Walsall. After Norton Junction the Lichfield and Derby line passes beneath the Midland Railway shortly before reaching Brownhills (London and North Western Railway) station, 5⅛ miles from Walsall. Pelsall, Brownhills, and Hammerwich all have 11 trains from and 10 to Walsall, inclusive of the journey performed to Lichfield and back about mid-day by the Rugeley rail-motor.

On Saturdays there is an extra train from Brownhills to Walsall and back, and on Tuesdays, Thursdays, and Saturdays a late train from Walsall to all these stations. All the trains call at every station, and, except in the one case above noted, run to and from Lichfield City station (10½ miles from Walsall). Between Brownhills and Lichfield are the Anglesea and South Staffordshire Waterworks sidings and Hammerwich station. All stations have two trains each way on Sundays.

The branch from Birmingham *viâ* Sutton Coldfield to Lichfield joins the Walsall and Lichfield branch just south of Lichfield City station, after passing through several Birmingham suburbs for about 8 miles and through very picturesque country for the remaining distance. At Blake Street station, 10¾ miles from Birmingham, this line enters the county of Staffordshire, and Shenstone is the only other Staffordshire station on the line. Both Shenstone and Blake Street are usually served by 10 trains in each direction daily, with one extra on Wednesdays, one less on Saturdays, and none on Sundays.

Proceeding northwards from Lichfield City station, the beautiful cathedral of Lichfield is seen on the left before reaching Lichfield (Trent Valley High Level) station. As before stated, this is immediately over and at right angles to the Low Level Trent Valley station on the main line. Including all trains, there are 15 passenger trains in each direction daily over the 1⅛ miles of line between the two stations at this "market city," for it is quite a small place of less than 8,000 inhabitants.

The Walsall and Derby route passes on to Midland metals at Wichnor Junction sidings (no station), 16½ miles from Walsall, 4¾ from Lichfield. The only station between Lichfield and Wichnor is Alrewas, where much good angling is to be had, and where all the 10 trains which daily run between Lichfield and Burton call. London and North Western trains then pass two stations on the Midland West of England main line—Barton and Walton and Branston—before reaching Burton-on-Trent.



Photo] [*Felix E. Jones.*

LONDON AND NORTH WESTERN RAILWAY LOCAL TRAIN AT SMETHWICK.
Worked by 2-4-2 tank engine No. 459.

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All London and North Western trains except two from Burton call at Barton and Walton station, but only one in each direction calls at Branston.

Beyond Branston towards Burton-on-Trent is Leicester Junction signal cabin. Here the Midland Railway branch to Coalville and Leicester and the London and North Western and Midland Joint line to Ashby-de-la-Zouch leave the Birmingham and Derby line. A through service is in operation between Euston and Buxton, *viâ* Rugby and Nuneaton, thence on to the joint (London and North Western and Midland) line through Market Bosworth, Shackerstone, and Ashby to Burton, where the coaches pass on to the North Staffordshire Railway, which conveys them *viâ* Ashbourne to Buxton.

Five London and North Western trains terminate at Burton, and five go on to Derby, the service in the reverse direction corresponding. Details of this service are as follows :—

Through trains from Birmingham to Derby *viâ* Four Oaks	3
Through trains from Birmingham *viâ* Four Oaks to Burton	2
Through trains from Birmingham to Derby *viâ* Walsall	1
Local trains from Lichfield to Burton and Derby	1
Local trains from Walsall to Lichfield, Burton, and Derby..	3
Total number of trains between Lichfield and Burton	10
Total number of trains between Burton and Derby	5

(*To be continued.*)

A LADY BOOKING CLERK AT WORK.

The Metropolitan Railway, in common with several other companies, has introduced lady booking clerks at several stations, and the photograph reproduced above shows the interior of the booking office at St. John's Wood Road station.

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SOUTH EASTERN AND CHATHAM RAILWAY:

Express Train travelling at 60 miles per hour near Grove Park.

Published by "THE RAILWAY MAGAZINE."

To face page 32.

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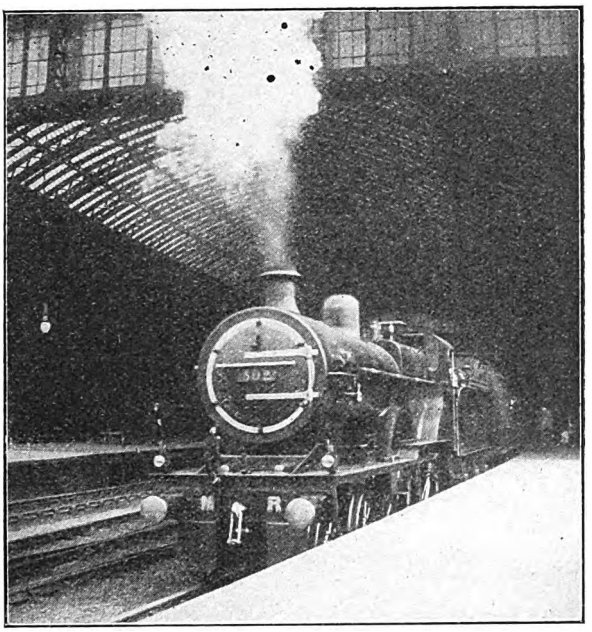
British Locomotive Practice and Performance.

By CECIL J. ALLEN.



Photo] [*A. C. Johnstone.*

MIDLAND RAILWAY.

Leicester and Nottingham Express leaving St. Pancras. Rebuilt 4-4-0 locomotive No. 502.

IN the last four articles the question of abnormal circumstances in running, both as regards exceptional loads and also *en route* delays, has been considered, and an attempt has been made to examine impartially the vexed question as to whether drivers can reasonably be expected to keep time with abnormally heavy trains, or to "make good" running delays. In the present issue I wish to make a few final remarks bearing on that topic, but instead of following the usual practice of instituting the discussion first, and illustrating it subsequently from running practice, I propose on this occasion to give the illustrations forthwith, and to "draw the moral" as we proceed. These illustrations consist of certain rather remarkable runs that I have enjoyed recently on the Great Northern Railway, which form the subject of the two tables reproduced herewith. A noteworthy feature of these journeys is the first-class work accomplished by engines of the standard Great Northern "Atlantic" type to which superheaters have lately been fitted.

The two runs numbered 1 and 2, with their continuations 5 and 6 in the second table, were made on the 2.20 p.m. Scotch express from King's Cross—a train that, since the commencement of the war, has been given to loading very heavily almost every day, extra vehicles being frequently attached at the last moment to accommodate the large number of passengers travelling. Consequently on these two occasions the load totalled 51 and 52 axles, although as certain of the extra coaches in each case were of earlier non-corridor types, the total weights did not exceed 350 and 355 tons respectively. Still, these were very substantial trains to haul over the long adverse grades of the Great Northern Railway to Grantham at an average speed of all but 52 miles per hour. The engine in each case was No. 1404, a standard "Atlantic" now superheater-equipped, and ably handled by Driver Wright, of Grantham, whose consistent times and good uphill work were specially worthy of note. Of the two runs the second was the finer, a string of five serious checks calling forth a magnificent effort to regain time on the most difficult stretch of the whole journey.

From King's Cross the initial stages of the two journeys were remarkable for their similarity, the times to Hatfield being almost exactly the same with no intermediate variation greater than 10 sec. On each run a slight permanent way check was experienced in Wood Green Tunnel, and on each occasion, also, an acceleration to exactly

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45 miles per hour was registered on the continuous 1 in 200 ascent to Potter's Bar. Another feature of each journey was the phenomenally rapid recovery of speed from Potter's Bar to Hatfield, the time of 4¾ min. between these points on the first run substantially beating all that I have been able to turn up with correspondingly heavy loads. Indeed, the net time of 24¾ min. from King's Cross to Hatfield on both trips is well-nigh a record with a train of 50 axles or over, such a booking as the standard Great Northern 23 min. to this point with all the chief down expresses being quite impossible of achievement save with comparatively moderate loads. As a matter of fact I have only been through Hatfield in 23¼ min. or less on five occasions in all my experience, which must now embrace nearly 200 down Great Northern runs (the 2.15 p.m. Leeds express alone excepted) and on all these five runs the load was one of 40 axles or less. On the first of the two runs now being described the speed beyond Hatfield was as high as 76·3 miles per hour, and on the second 73·8.

This rapid running on the second journey resulted in our being very severely slacked for signals at Digswell Box, evidently on account of a preceding goods not having quite "cleared" into the loop road at Woolmer Green Box ahead. Now herein lies a difficulty, arising out of the exceptionally fast running of an express in regaining lost time. The task of a signalman at an intermediate box on a main line, where much heavy goods and slow passenger traffic, in addition to express trains, requires to be dealt with, is by no means an easy one. His task is further complicated when, as at this point, four running roads converge

GREAT NORTHERN RAILWAY: KING'S CROSS-GRANTHAM

Distance ex-London	Run No. .. .. / Engine 4-4-2 (superheater) .. / Driver .. .. / Load (axles) .. / Load (tons) ..	No. / Schedule Times.	1	2	Schedule Times.	3	Schedule Times.	4	Distance ex-Peterborough.
			1404 Wright 51 350	1404 Wright 52 355		1447 Ducker 44 335		1428 F. Hill 51 355	
Miles.		MINS.	M.S.	M.S.	MINS.	M.S.	MINS.	M.S.	MILES.
0·0	King's Cross ..	0	0.00	0.00	122	122.20	90	88.50	76·4
2·5	Finsbury Park ..	—	6.40	6.50	—	118.30	—	84.45	73·9
			a	*a*				*l*	
12·7	Potter's Bar ..	—	20.55	20.45	—	109.05	—	72.55	63·7
17·7	Hatfield	23	25.40	25.40	101	103.50	70	67.45	58·7
				d					
25·0	Knebworth ..	—	33.00	35.05	—	95.40	—	60.40	51·4
			b	*b*		*b*			
31·9	Hitchin	38	43.00	45.00	85	83.50	54	50.50	44·5
						h			
37·0	Arlesey	—	47.25	49.10	—	75.00	—	44.55	39·4
				e					
44·1	Sandy	—	53.55	56.25	—	68.00	—	37.25	32·3
51·7	St. Neots	—	61.30	64.25	—	61.15	—	30.15	24·7
				f					
58·9	Huntingdon ..	66	68.45	72.35	54	54.50	22	23.40	17·5
63·5	Abbot's Ripton ..	—	74.25	78.50	—	49.40	—	17.50	12·9
								k	
72·6	Yaxley	—	82.40	86.35	—	39.40	—	6.55	3·8
76·4	Peterborough¶ ..	85	86.50	90.30	33	34.10	0	0.00	0·0
						g			
81·9	Helpston	—	94.45	98.20	—	26.30	—	—	—
88·6	Essendine	—	101.25	105.00	—	21.25	—	—	—
97·1	Corby	—	111.45	115.10	—	14.25	—	—	—
100·1	Stoke	—	116.05	119.20	—	11.00	—	—	—
			c						
105·5	Grantham	122	123.35	125.30	0	0.00	—	—	—
105·5	Net times (mins.) ..	122	118	116½	122	†115½	*90	*84½	*76·4

a—Permanent way check, slight, Wood Green tunnel; *b*—Permanent way check, very severe, Langley; *c*—Permanent way check, Great Ponton; *d*—Severe signal check, Digswell; *e*—Signal check, Stratford Brook; *f*—Permanent way check, Offord; *g*—Severe slack for Werrington troughs; *h*—Severe permanent way check, Three Counties; *k*—Severe permanent way check, Wood Walton; *l*—Permanent way checks, severe, Potter's Bar N. tunnel and New Southgate.
* Peterborough to London. † No allowance for slack over troughs. ¶ Service slack, severe.

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that he expected her to pass in about a minute. From this our friend at Digswell would calculate that he need not expect the express in less than 10½ min.—an average time with a train of this weight—and that there would be just time to allow a goods train, then approaching on the slow line, on to the main line, and through into the loop at Woolmer Green, without delaying the "Scotsman." But this is where our driver, by his brilliant effort past Hatfield, falsified the calculations. Instead of taking the usual 10½ min., we only took 9½ min., and this one minute was just sufficient to cause us a serious check. Possibly the goods train also was unduly sluggish in clearing Woolmer Green, but in any case it is impossible always to blame a signalman for delays of this sort, which are often purely and simply misfortune. This, then, is another consideration in the matter of regaining lost time, and one that is but rarely thought of; the mention of it may serve to mollify the feelings of some co-enthusiast whose prospective "record of records" has been irretrievably marred by an admittedly exasperating signal check *en route*.

The next delay, which occurred on both runs, was that at Langley, where the burrowing junction with the new Enfield–Stevenage loop line is under construction; this has been a chronic source of delay in both directions for some time past, and seems likely to remain so. Moreover, it is a bad "strategic" point, being situated at the foot of adverse grades in each direction. It is interesting again to notice the consistent running of Driver Wright in that his times from Knebworth to Hitchin, inclusive of a very severe slack in each case, only vary by 5 sec. From Hitchin to Huntingdon run No. 1 was inclined to be disappointing, even though 2¼ min. were gained on booked time; the booking between these points, of course, is of little value, as it can hardly be expected that any driver would cover so favourably graded and perfectly aligned a stretch of line at an average speed of barely 58 miles per hour! Such times as this and the 23 min. allowance from King's Cross to Hatfield,

GREAT NORTHERN RAILWAY: PETERBOROUGH–YORK.

Distance *ex*-Grantham	Run No.	Schedule Times.	5	6	Schedule Times.	7	8	Distance *ex*-Doncaster.
	Engine, 4-4-2 No. ..		‡257	‡949		299	¶1428	
	Driver		Doolan.	Hawbrook.		Waller	F. Hill	
	Load (axles)		51	52		47	42	
	Load (tons)		350	355		330	300	
Miles.		MINS.	M.S.	M.S.	MINS.	M.S.	M.S.	MILES.
—	Peterborough	—	—	—	93	90.10	89.15	79·6
—	Helpston	—	—	—	—	83.35	82.40	74·1
—	Essendine	—	—	—	—	78.10	76.50	67·4
—	Corby	—	—	—	—	71.30	69.25	58·9
—	Stoke	—	—	—	—	68.10	66.00	55·9
0·0	Grantham	0	0.00	0.00	60	60.20	58.35	50·5
6·0	Hougham	—	8.55	9.45	—	51.20	*g* 49.15	44·5
14·6	Newark	17	16.10	*d* 19.05	42	41.35	39.40	35·9
20·9	Carlton	—	*a* 21.55	*e* 35.15	—	35.40	*f* 33.45	29·6
26·4	Tuxford	—	30.30	42.50	—	30.30	28.55	24·1
33·1	Retford	39	38.10	50.40	21	21.50	21.20	17·4
42·2	Bawtry	—	46.40	60.05	—	12.25	12.30	8·3
50·5	Doncaster	58	*b* 56.00	69.30	0	0.00	0.00	0·0
52·6	Arksey	—	59.50	71.45	—	—	—	—
60·5	Balne	—	68.30	80.10	—	—	—	—
68·9	*Selby	79	77.40	89.10	—	—	—	—
75·6	Escrick	—	86.55	97.45	—	—	—	—
82·7	York	97	*c* 97.00	106.25	--	—	—	—
§82·7	Net times (mins.).. ..	§ 97	§90¼	§93¼	‖93	‖90¼	†‖87½	‖79·6

a—Permanent way check, 125¼ mile post, very severe; *b*—Permanent way check, Doncaster station subway, very severe; *c*—Signal check, Chaloner Whin junction; *d*—Permanent way check, Claypole; *e*—Signals, Trent box, dead stop; *f*—Muskham troughs, slack; *g*—Permanent way check, Barkstone, severe.
* Service slack, swing-bridge. † No allowance for slack over troughs. ‡ Small "Atlantic," 990 class. ¶ Superheater. § Grantham–York. ‖ Doncaster–Peterborough.

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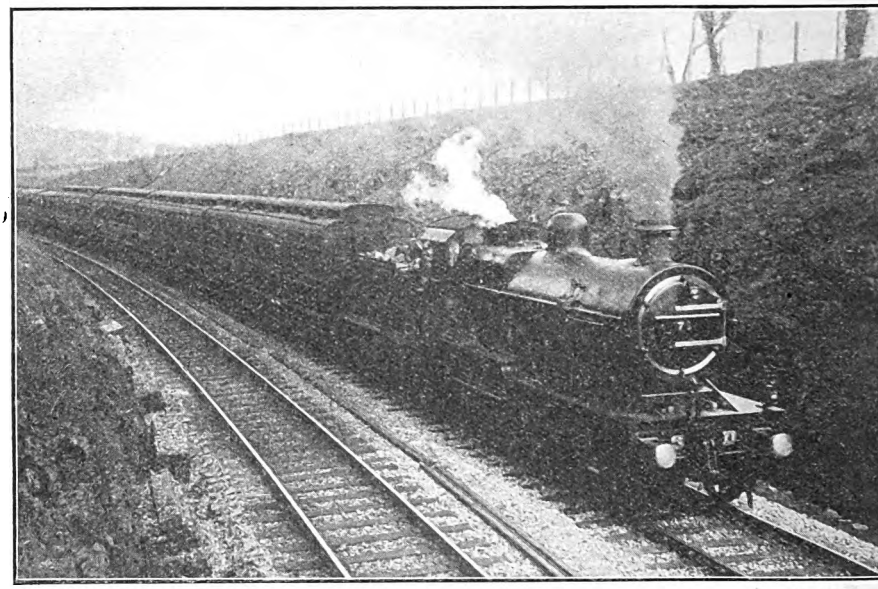

Photo] [*L. Belloc.*

SOMERSET AND DORSET JOINT RAILWAY.

Bath-Bournemouth Express, with through Midland Railway Restaurant Car train from the North, ascending a bank of 1 in 50 near Chilcompton.

Rebuilt 4-4-0 locomotive No. 71.

by a permanent way check at Great Ponton, but the second finished briskly, the arrival being only 3½ min. behind time despite five delays costing fully 9 min. in all. The unsparing efforts of Driver Wright to regain lost time on each journey were really praiseworthy, the net gain of 2½ min. on the first trip and 3 min. on the second between Huntingdon and Grantham being specially worthy of note, as this is the most difficult part of the whole journey from the schedule standpoint.

It may be as well to continue the descriptions of these runs to York forthwith. Curiously enough, we were taken forward from Grantham on each occasion by one of the smaller "Atlantics," whose work, though often variable, can be really brilliant in the hands of capable drivers. So it was on these two occasions, and more particularly the first, when the engine was No. 257, in charge of Driver Doolan, of Grantham shed. The start from Grantham was magnificent, the speed being sustained for miles beyond Hougham at 72·5 miles per hour, so that Newark was passed in the exceptional time, considering the load, of 16 min. 10 sec. So well sustained was the rate on the level stretch beyond that we passed the 125¼ mile-post, 19·8 miles from the start, in 20 min. 35 sec., but immediately beyond we encountered a very severe permanent way check, which seriously hampered the subsequent ascent of Tuxford bank. Notwithstanding even this delay, we gained nearly a minute to Retford.

Excellent running continued, the speed at Scrooby being 66 miles per hour, and at Piper's Wood summit as high as 49·5, but adverse signals approaching Doncaster heralded another severe check through that station on account of the new subway then constructing. The time of 56 min. to Doncaster would have been quite good with no delays, but the net time of 52½ min. was exceedingly fine with this load. An uneventful run to York followed the recovery from the Doncaster slack, the latter *plus* a signal check at Chaloner Whin junction sufficing to lose the 2 min. gained on the earlier part of the run, so that the actual time from Grantham to York was exactly as booked. But allowing for the three checks, and especially the first and second, for each of which speed was badly reduced from a fairly high figure, the net time from Grantham to York did not exceed 90½ min. This net gain of 6½ min. on booked time was one for which driver Doolan deserves congratulation. A somewhat astonishing

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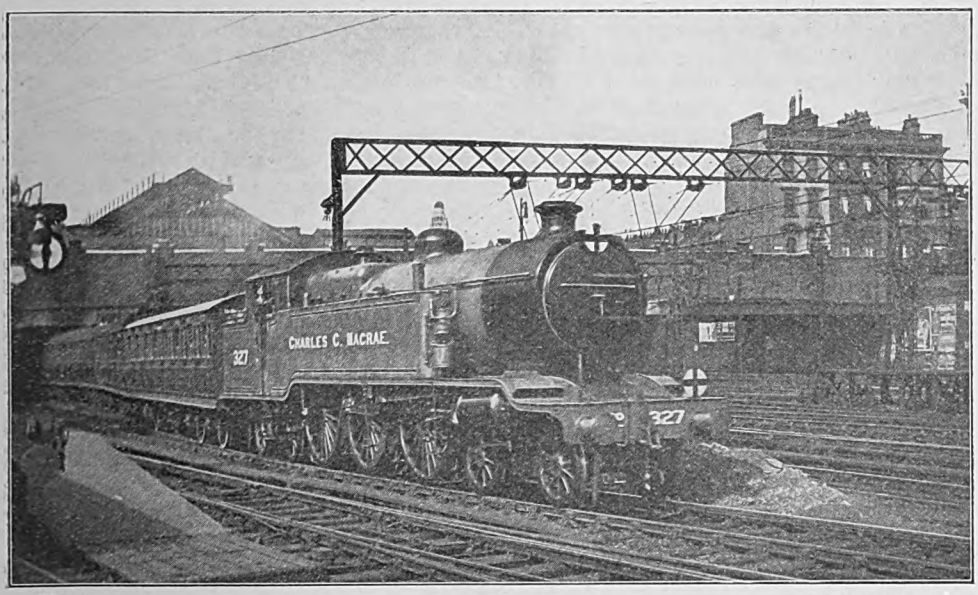
feature of this run from London was that, despite five permanent way checks (three of which were very severe indeed) and one signal check, the train arrived at York only 1¾ min. late, the final signal check exactly accounting for this loss. One is bound to confess that this is very much above one's average experience of the Great Northern Railway with loads of 50 axles or over.

The second run beyond Grantham—No. 6 in the tables—was not so noteworthy, although quite good apart from delays, the engine in this case being No. 949, driven by Hawbrook. In its early stages we were again sadly afflicted with delays, a permanent way slack at Claypole being succeeded by a dead stand at Trent Box for some minutes on account of a goods train having broken away on the up line. It turned out that no vehicles of the latter had left the road, but we were again slacked badly at Muskham before finally getting away, having now, of course, lost a good deal more time than it was possible to regain. In fact, Hawbrook made no special effort to regain time until after we had passed Doncaster, the work between Retford and Doncaster being decidedly inferior to that of the preceding run. But beyond Doncaster we did exceptionally well, gaining over 2 min. on a booking which, including as it does the Selby slack, is in the case of heavy trains by no means as easy as it looks on paper. The net time of 93½ min. is carefully calculated from contemporary runs, the 1½ min. beyond the gain north of Retford representing the average curtailment of the unnecessarily easy allowance of 22 min. from Newark to Retford. Both these runs, therefore, were decidedly unusual in character, the former showing an aggregate gain to locomotives of 10½ min. from London to York, and the latter of 9 min., in each case with really substantial trains.

I wish now to deal briefly with the up runs that appear in the tables, as these were also uncommonly good. The train from Doncaster in runs 7 and 8 was the 1.3 p.m. (1.5 p.m. working time), which leaves Newcastle at 10.28 a.m., and is due at King's Cross at 4.10 p.m. (4.12 p.m. working); it always conveys a heavy load, and has not a particularly enviable record for punctuality. On the first run we left York 7 min. late—and were hauled by a small 4-4-0 of Class W—No. 1368, Driver Banyard—as far as Doncaster; the load was a moderate one of 290 tons. But the small engine did excellently, the start to stop time from York to Selby being 18 min. 35 sec., and from Selby to Doncaster 22 min. 25 sec., with a



Photo] [*H. G. Cogger.*

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.
3.53 Portsmouth train leaving Victoria.
4-6-4 tank engine No. 327, *Charles C. Macrae.*

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Photo] [*A. F. Shoults.*

NORTH BRITISH RAILWAY.

3.12 p.m. Edinburgh-Aberdeen Express at Inverkeithing. Great North of Scotland Elgin coach next engine.

4-4-0 locomotive No. 896, *Dandie Dinmont.*

sustained speed of 62.5 miles per hour on the level south of Balne. In this way a minute was gained to Doncaster. At Doncaster we attached the Hull twelve-wheeler in the usual course, making the load up to 330 tons, and left 5 min. later behind No. 299, driven by Waller. The early stages of the run were not remarkable—in fact, the uphill work, with minimum speeds of 39·1 miles per hour at Askham bank, 37·5 at Peascliffe tunnel, and 38·5 at Stoke, in each case on a 1 in 200 grade, was decidedly sluggish, and no time was gained to Grantham. But a very rapid descent to Werrington followed, with a sustained maximum speed of 80·3 miles per hour, the 17 miles from Corby to mile-post 80 taking only 13 min. 35 sec. and therefore we economised over 3 min. on schedule between Grantham and Peterborough alone. Thus we reached Peterborough only 2 min. late, the engines having gained 4 min. between them, and smart station working at Doncaster another minute. South of Peterborough, however, delays spoiled the remainder of the run.

No. 8 run constituted another remarkable example of the hauling powers of the superheater-fitted "Atlantics." The engine in this case was No. 1428, and the driver F. Hill; the load was only moderate from Doncaster, as the excessive weight of the train at that point necessitated a division, the Hull portion following later. We started 25 min. late. Once past Bawtry, all the times were a substantial improvement on those of the preceding run, the hill-climbing in particular being noteworthy. The minimum rate at Askham was 47·4 miles per hour—against 39·1 before—and the maximum speed at Crow Park 73·8 miles per hour, against the previous 69.2. Had it not been for the customary and somewhat inexplicable slack over Muskham troughs, indeed, we should have been through Newark in about 39¼ min., or 2¾ min. under schedule. This delay hampered our subsequent ascent to Grantham, but a much worse loss of time was occasioned by a bad permanent way check at Barkstone, costing nearly 2 min. With these hindrances on the second run, therefore, there was not much variation in the total time occupied between Newark and Stoke on each run. Once over Stoke summit, the work of No. 1428 on the falling grades was decidedly disappointing, in view of the lateness of the train; no higher speed than 73·8 miles per hour was touched, and 1¼ min. were lost on the times of the preceding run between Stoke and Helpston. Nevertheless the conclusion of the run showed a gross gain of 3¾ min. on booked time, and a net gain of 5½ min. With full speed over Muskham troughs and down Essendine bank, the 79·6 miles from Doncaster to Peterborough might have been covered in the noteworthy time of 85½ to 86 min.

The continuation of this run to London

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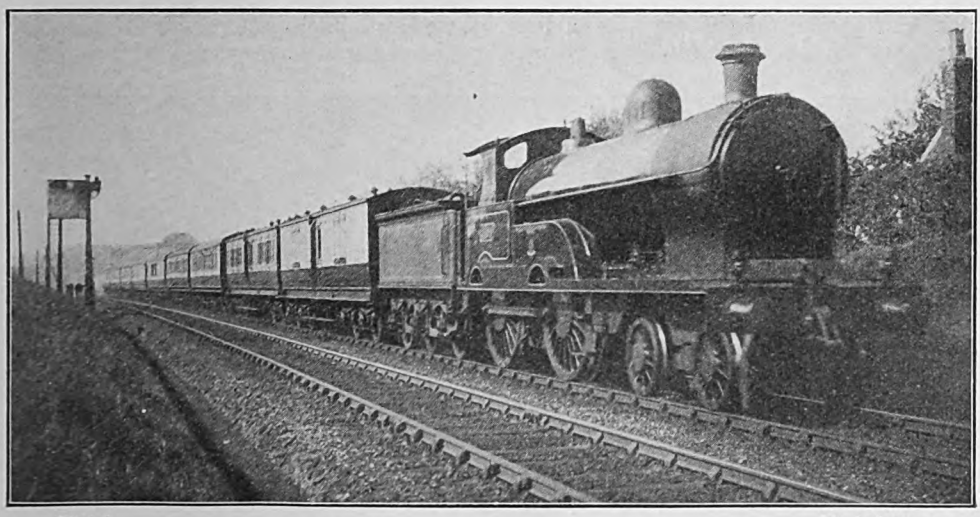
with the same engine was decidedly interesting, and appears in column 4. Extra vehicles were attached at Peterborough, bringing our load up to 51 axles, or 355 tons. Delays began early, a bad permanent way check beyond Holme adversely affecting the ascent of Ripton bank, and causing us to exceed the allowed time to Huntingdon. But from there we achieved the excellent feat of running to Hitchin, 27 miles, in 27 min. 10 sec.—nearly 5 min. under booked time !—over a road with a rising tendency throughout, and a decidedly steep rise in the last 9 miles. Our speed at Huntingdon was 69·2 miles per hour and at Offord 70·3 ; at St. Neots, after 2¼ miles up at 1 in 579 and 1¼ at 1 in 200, it fell to exactly 60. Needless to say, the booking from Huntingdon to Hitchin is unnecessarily generous, which is the more surprising in that most of the Great Northern uphill times—as, for example, King's Cross to Hatfield—are exactly the opposite. Once again the brilliance of the running fell off beyond Hitchin, the speed at the summit of the 1 in 200 rise to Stevenage being only 37·5 miles per hour, and in consequence of this we lost a minute on schedule from Hitchin to Hatfield. Good work was done from Hatfield to Potter's Bar, but two further serious delays south of Hatfield left us with a gross gain of only 1 min. 10 sec. on schedule on arrival at King's Cross. The net time of 84½ min. from Peterborough, however, evidenced remarkably fine work with a load of 51 axles, for which Hill deserves all credit ; in fact on the whole journey from Doncaster there was a net gain to the engine of no less than 11 min.

The finest run of the whole series, however, was that on the up day "Scotsman" which occupies column 3. In this case again the engine was a standard "Atlantic," recently superheater-equipped, the driver being Ducker, whose work throughout was simply magnificent. This train was, at the time I secured the run, composed of the new and heavy eight-wheeled stock throughout, so that although the number of axles was appreciably less than conveyed on runs 1, 2 and 4, the actual load was nearly the same. A very fair climb was made to Stoke, speed rising to 37·5 miles per hour on the continuous 1 in 200 grade, after which followed another very fast descent to Peterborough, speed again being maintained at 80·3 miles per hour for some distance. The time in this case from Corby to mile-post 80½, 16½ miles, was 13 min. 10 sec., involving an average speed of over 75 miles per hour throughout. But much of the value of this rapid running was lost by a most painfully cautious negotiation of Werrington troughs —at a speed of 33 miles per hour !—which cost us a full two minutes as compared with the continuation of full speed until the necessary slack for Peterborough. Consequently our time to Peterborough was more than a minute over that scheduled.



Photo] [*R. J. Osborne.*

LONDON AND NORTH WESTERN RAILWAY.
11.25 a.m. Birmingham-Euston Express near Coventry.
4-4-0 superheater locomotive No. 1489, *Wolfhound.*

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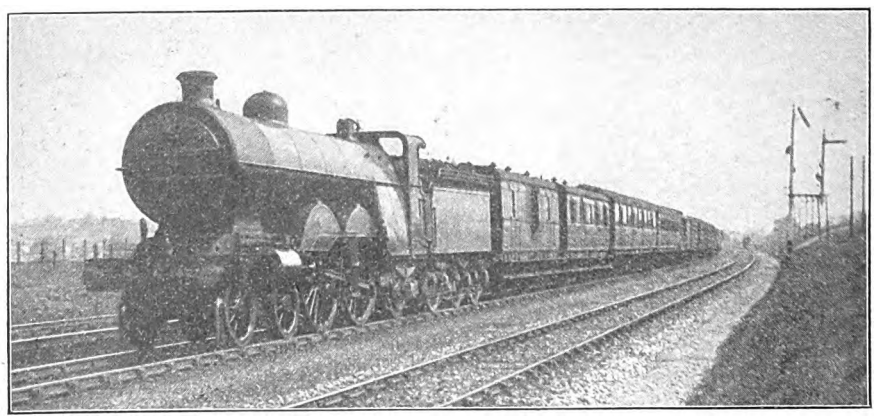
We recovered fairly well from Peterborough slack, speed rising to 62·5 miles per hour on the level at Holme, and not falling below 42·9 on the 4 miles' ascent at 1 in 200 past Ripton, but not more than 20 sec. had been gained from Peterborough when we passed Huntingdon. Now, however, there followed a truly phenomenal speed effort—quite the fastest, indeed, that I have ever timed in this direction with a load anything like as heavy. At Huntingdon the top speed was 69·2 miles per hour, while after St. Neots the rate rose to 71·4; on the slight rise to Sandy we fell to 65·2, but at Biggleswade the train was again travelling at 69·2 miles per hour. The ascent to Arlesey brought us down to 56·3, but the very brief spell of favourable grades beyond brought us finally to the mile-a-minute rate again, before an exceedingly severe permanent way check just beyond Three Counties wrecked my rising hopes of a record time from Huntingdon to Hitchin. In any case, our time of 20 min. 10 sec. for the 21·9 miles from Huntingdon to Arlesey was quite unprecedented, in my experience, on a train of this character, and an unchecked run to Hitchin would have enabled us to cover the 27 miles from Huntingdon to Hitchin in a fraction under 26 min., the booking for this distance being 31 min. The Three Counties slack was not our only difficulty, as it was followed by the chronic Langley caution, the two between them dissipating all our economy on schedule time, and more as well. But a very smart run in from Hatfield gained a further 2½ min. on the easy concluding booking, and we arrived within a few seconds of the 122 min. allowed. Calculating on the basis of run 4, the two delays, both very serious, cost us 6 min., but allowing for the better average uphill work of run 3, our net time from Grantham to London certainly did not exceed 115½ min. Without the wholly unnecessary slack at Werrington it would have been possible to make the journey in 113½ min., or 8½ min. under booked time, the running being thoroughly commendable in character throughout.

The question has often been discussed in these columns and elsewhere as to why the uphill work of the Great Northern Railway—and that of other lines, as, for example, the London and South Western and South Eastern and Chatham—does not appear to come up to the standard of that in vogue elsewhere. This raises a very interesting point. It is an undoubted fact that locomotive performance on long-sustained grades, even though they be fairly moderate in inclination, does not as a rule come up to that on sharply undulating stretches of line, where there is no limit to maximum speeds on the favourable gradients. For example, it would generally be agreed that London and South Western locomotive running usually shows to better advantage between Salisbury and Exeter than between London and Salisbury, seeing that the booked speeds on these two stretches of line, so absolutely different in grading, are—or were, until recently—almost identical. A correspondent's recent letter emphasises the probable reason for this. The prolonged ascent, even if moderate in character, calls for an equally prolonged drain on the steam-raising capacity



Photo] [*F. W. Curtis.*

GREAT NORTHERN RAILWAY.

1.45 p.m. King's Cross–Peterborough train.

4-4-2 locomotive No. 1428.

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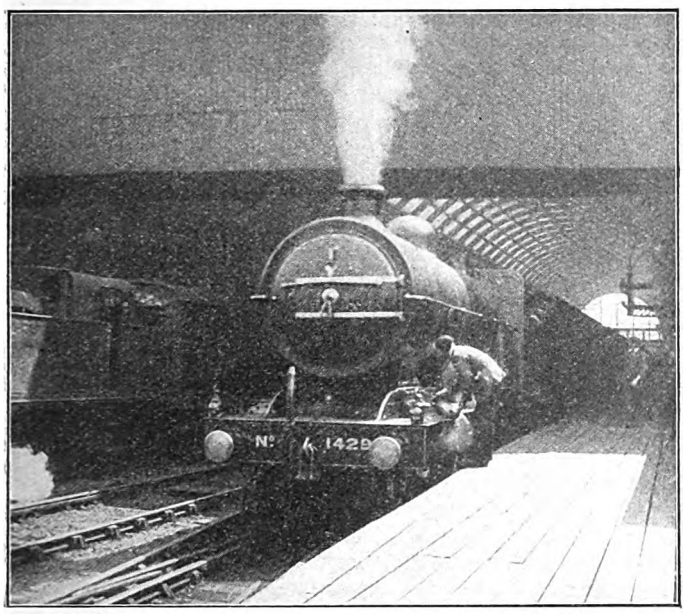

Photo] [*A. C. Johnstone.*

GREAT NORTHERN RAILWAY.

York train about to leave King's Cross.
4–4–2 locomotive No. 1429.

of the engine, if a high speed is to be maintained, necessitating arduous work for the fireman, and a strain on the machine generally. Whereas the undulating road calls for a succession of such efforts, but each of comparatively short duration, alternated with stretches of easier running, or "breathing spaces," on which the momentum of a high speed is stored up for use on next following ascent.

Now the Great Northern main line is divided into clearly defined "sections." On the down journey, for example, drivers have first to face the almost unbroken and steep ascent of 12¾ miles to Potter's Bar. From there to Peterborough ensue 63½ miles of undulating grades, terminating in a slack at the latter station. The acceleration from that slack has to be made on a rising grade, and then, after 4 miles of faintly favourable grades, there follows the toilsome rise of 19 miles to Stoke box, the last 10 of which are really steep. Beyond Stoke there are no further difficulties worth mentioning. Now the work of the Great Northern "Atlantics" with heavy trains between Potter's Bar and Peterborough is unquestionably very fine, and consistently so, but it is more on the ascents to Potter's Bar and to Stoke summits, with the corresponding climbs in the opposite direction, that the Great Northern hill-climbing reputation is based. The uphill work on these banks is certainly exceedingly variable. Only recently, on the 10 a.m. "Scotsman" *ex*-King's Cross, with a standard "Atlantic" whose number shall be veiled in obscurity, and a load of 48 axles, or 365 tons, we took a modest 27 min. to get through Potter's Bar, and 32 min. 55 sec. to Hatfield (all but 10 min. over the requirements of the time table), the Langley check caused the loss of a further minute between Hatfield and Hitchin, which was passed in 48 min. 50 sec. from the start, 10 min. 50 sec. behind time. From Hitchin we covered the 44½ miles to Peterborough in 41¼ min.—5¾ min. *under* booked time—and it took us finally 42 min. (an additional loss of 7 min. on the time table) to struggle over Stoke summit into Grantham. The gross time from London to Grantham was thus 132 min. 5 sec. and the net 130 min., this loss of 10 min. being directly due to the extraordinarily poor work uphill. This is what I meant in the last issue when I spoke of hill-climbing being the key to the whole time-keeping question in the case of heavy express trains on hilly roads. It is absolutely so on the Great Northern Railway.

Before closing this article I must give publicity to another superb run which I enjoyed recently on the Great Central Railway—a line which, as we have seen in recent articles, is considerably more difficult from the grading standpoint than the Great Northern Railway, but is very differently placed in the matter of loads. Indeed, the driver's estimate of his five corridor vehicles as "just a nice train" is one which would scarcely find enthusiastic support in the traffic departments of, say, the Great Northern Railway or the London and North Western Railway! The engine was No. 430, *Purdon Viccars*, of the large 4–4–0 "Director" class, driven by Atkinson, and the load 20 axles, which, consisting as it did of the old Bradford dining-car set, would not weigh

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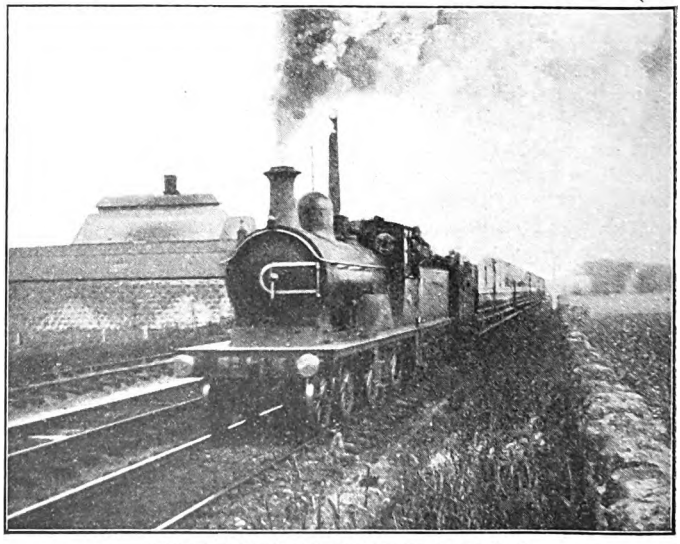
with passengers and luggage a total of more than 135 tons; the train was the 10 a.m. *ex*-Marylebone. We were appreciably delayed at the start by having to take the loop road from Neasden Junction to Blind Lane Box, with very bad slacks at each point, but contrived, nevertheless, to pass Northolt Junction, 11·6 miles, in 17¼ min. —only ¼-min. over booked time. Accelerating rapidly on the level, we passed Ruislip at 60 miles per hour, but were then checked quite severely at Denham East; this delay, however, did not disconcert the driver, who accelerated his engine up the continuous 1 in 175–254 beyond to no less than 59·2 miles per hour—we should have passed the magic 60 had the bank been only a little longer! —before topping the summit near Beaconsfield. Our time from Northolt to Denham, 4·5 miles, was 5 min. exactly; from Denham to Beaconsfield, 6·9 miles, 7 min. 20 sec.; and with a smart descent to High Wycombe at 71·4 miles per hour we completed the journey of 27·9 miles from London in 34 min. 55 sec., or 32 min. net—allowed 36 min.

The next stretch of the journey, as our American cousins might aptly remark, "licks creation." After about a mile of level track the line rises from Wycombe, first at 1 in 176 and then continuously at 1 in 164 to the summit point beyond Saunderton; up this grade we accelerated to a steady 56·3 miles per hour, with the result that Princes Risborough, 8·1 miles from Wycombe, was passed in the astonishing time of 10 min. 20 sec. The booked allowance is 12 min. It is not often that Great Central drivers take the favourable grades between Risborough and Ashendon Junction at a particularly high speed, but on this occasion our rate rose to a sustained 77·5 miles per hour, the 9·4 miles from Risborough to Ashendon consuming only 7 min. 50 sec., and the undulating 5·9 miles thence to Grendon Underwood 5 min. 20 sec. We had therefore covered the 23·4 miles from Wycombe to Grendon in 23½ min. (allowed 26 min.), but, although we were now well before time, there was no slackening of effort on the subsequent steeply ascending grades, where all my previous records "went by the board." On Finmere bank, 5¼ miles long, of which 3 are 1 in 176, our sustained minimum speed was 58·4 miles per hour; on Brackley bank, 4½ miles long (3¾ at 1 in 176) it was 57·7; while the short descents at 1 in 176 beyond Calvert (¾-mile), Finmere (1¼ miles) and before Helmdon (¾-mile) produced maxima of 70·3, 71·4 and 64·3 miles per hour respectively! The adverse banks, indeed, might almost have been non-existent for any effect that they had on our average speed. From Grendon to Calvert, 2 miles, we took 1 min. 50 sec.; from Calvert to Finmere, 5·7 miles, 5¼ min.; from Finmere to Brackley, 4·8 miles, 4½ min.; and from Brackley to Culworth, 6·8 miles, 6¾ min. In this way Culworth, 42·7 miles from High Wycombe, was passed in 41 min. 50 sec. from the start, the intervening 34·6 miles from Princes Risborough having only occupied 31½ min.

As we were now about 4 min. before time, it was a matter of no surprise that we were brought to a dead stand at Culworth Junction for signals. We stopped very slowly, but despite this we had covered the 44 miles from High Wycombe, start to stop, in exactly 44 min. This really was a phenomenal feat, even with so light a load as 135 tons, as it must be remembered that the vertical rise from Wycombe to Culworth



GREAT NORTH OF SCOTLAND RAILWAY.

8.5 a.m. Aberdeen-Inverness train near Dyce Junction. 4-4-0 locomotive No. 29.

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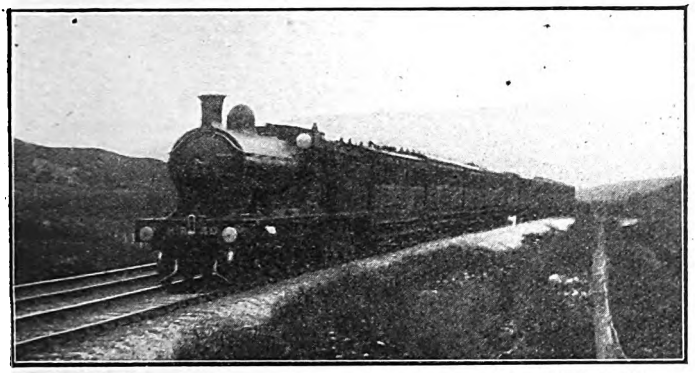


Photo] [*Tom M. L. Neish.*

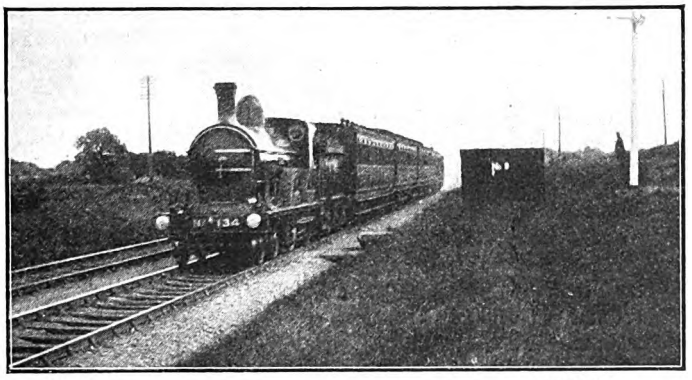
HIGHLAND RAILWAY.

11.50 a.m. Perth-Inverness train at Drumochter Pass Summit. 4–6–0 locomotive No. 30, *Dunvegan Castle.*

junction is as much as 510 ft. Indeed, this mile-a-minute average quite puts in the shade even that of the vaunted "Fastest Train in the British Empire"—the 1.9 p.m. from Darlington to York, North Eastern Railway, which is booked to cover an exactly similar distance, on a road fractionally easier than level throughout, in 43 min. After standing at Culworth Junction for 45 sec., we proceeded to Woodford, and still contrived to arrive 15 sec. before time. But our net time was not more than 45 min. for the 45·7 miles—a clear gain of 4 min. on a "tight" schedule.

The remainder of the journey was almost featureless by comparison with the foregoing. From Woodford we passed Charwelton, 2·4 miles, in 4 min. 10 sec., attained a speed of 79 miles per hour down Catesby bank, passed Braunston, 9·4 miles, in 10¼ min., and reached Rugby 14·1 miles, in 14¾ min., start-to-stop. The booking in this case is 16 min. to clear Rugby, which we managed to do in 15½ min. From Rugby another magnificent start was made, the 120¾ mile-post, 2 miles distant, being passed in 3 min. 5 sec., at all but 60 miles per hour. Up the first stretch of the succeeding bank—3 miles at 1 in 176—the speed merely fell from 59·2 to 57 miles per hour, and up the second 1½ miles at the same inclination to 58·5, the intervening maximum being 65·2. The final descent to Leicester was then taken very easily, much of it without steam, and at no higher maximum speed than 75 miles per hour; Lutterworth, 6·8 miles from Rugby, was passed in 7 min. 55 sec., Ashby, 10·7 miles, in 11 min. 35 sec., and Whetstone, 15·2 miles, in 15¼ min. Eventually we stopped at Leicester, 19·9 miles from Rugby, in 20½ min., having gained a further 1½ min. on schedule time. Driver Atkinson is to be congratulated on such really magnificent work, of which this is evidently not an isolated example, seeing that I have quite unexpectedly received from two different correspondents records of equally surprising feats by the same engine and driver on the Manchester and Sheffield line. But a description of these must wait until I have an opportunity of dealing with my own varied collection of runs over the same route.

In closing I want to mention briefly a couple of smart runs which come within the "abnormal load" category. One was made recently on the 8.50 p.m. Scotch express *ex*-Euston, which loaded to the vast figure of 14 eight-wheelers, and a 12-wheeled "sleeper"—62 axles, 411 tons empty, and, as the major portion of the train consisted of vans packed with luggage of various sorts, fully 440 tons in all. We were, of course, piloted to Willesden, and there our 4–4–0 superheater engine No. 2081, *Traveller*, found considerable difficulty in getting away—so



Photo] [*J. B. Minns.*

GREAT NORTHERN RAILWAY (IRELAND).

Belfast-Londonderry Express near Knockmore Junction. 4–4–0 locomotive No. 134.

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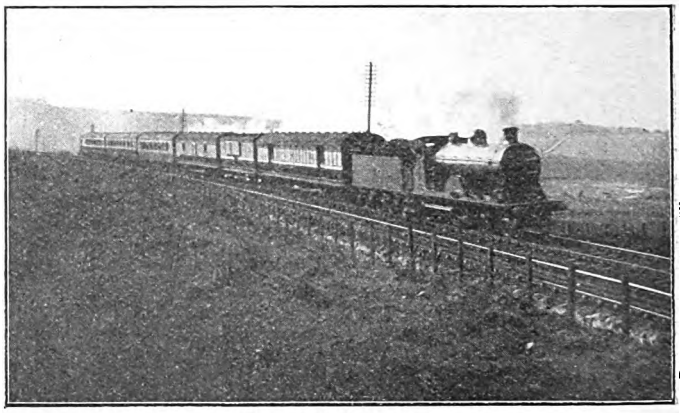
much so, indeed, that we stood at Willesden for 10¾ min. But once "off the mark," *Traveller* made light of this tremendous train. Harrow, 5·9 miles, was passed in 9 min. 55 sec., Watford, 11 miles, in 17 min. 25 sec., at 55·6 miles per hour, and Tring, 26·1 miles, in 33 min. 40 sec., the speed on the long 1 in 330 ascent not falling below 49 miles per hour. The latter was another astounding feat of hill-climbing for a 4–4–0 engine with such a load. We ran well at 67 miles per hour past Cheddington and Leighton, the 15 miles from Tring to Bletchley taking 14 min. 5 sec. At Bletchley the speed was 65·2 miles per hour, and at Wolverton 66·1, the 8·1 miles from Bletchley to Castlethorpe occupying 7 min. 40 sec. From Castlethorpe up to Roade the 5 miles, inclusive of the cross-over slack from fast to slow roads, took exactly 6 min., and the final 6 miles into Northampton were reeled off smartly in 7 min. 20 sec. Consequently *Traveller*, in covering the 60¼ miles from Willesden to Northampton in 68¾ min., had regained 4¼ min. of the lost time, in addition to making the run in a time of only ¾ min. over the fastest booking of the day between these points. And this with 440 tons!



CALEDONIAN RAILWAY.
3.40 p.m. postal train from Aberdeen.
Superheater 4–4–0 locomotive No. 148.

On the other run the load was not so heavy, but I mention it more especially as I have already cited the work of the small "Atlantics" on the Great Northern Railway, of which this was a particularly praiseworthy little sample. The train was the 6.50 p.m. from York to London, the load 7 corridor eight-wheelers and 4 twelve-wheelers, 52 axles, or 370 tons, and the engine No. 260, rebuilt with extended smoke-box but without superheater. Escrick, 7·1 miles, was passed in 10 min. 55 sec. from York, and Selby, 13·8 miles, in 17 min. 50 sec., the speed between these points rising to 62·5 miles per hour. Speed was reduced at Selby, but quickly recovered, the 4·6 miles on to Templehirst only taking 5¾ min. From Templehirst the 11·7 miles to Arksey were covered in 11 min. 55 sec., the engine running freely with this heavy train on a level track at 63·8 miles per hour. Signals were on outside Doncaster, so that our time from York to the dead stand was one of 38 min. 50 sec., but our net time could have been but little above 38 min., or 2 min. under schedule. This is quite a fit "complement" to the achievement of No. 949 in the opposite direction, with an exactly corresponding number of axles.

It will be noticed in this article that I have used a different system of mileage notation to that usually employed. As a matter of fact, I find it difficult to decide matters of this kind. In regard to times, as readers will have noticed, I usually time to the nearest 5 sec., as this is quite sufficiently accurate for all ordinary purposes. It is obviously immaterial to the average layman, for example, whether an express left King's Cross at 9.59.59 or 10.00.01 a.m.! But this occasions a difficulty in choosing a suitable notation for mileage. Quarters of a mile are really not sufficiently accurate in comparison with twelfth parts of a minute, while to the ordinary reader the use of miles and chains coupled with minutes and seconds makes the reading of an article of this character a dreadfully complex affair. In future, therefore, with certain exceptions, I propose to use decimal parts of a mile—*i.e.*, tenth parts of a mile in conjunction with twelfth parts of a minute, which is reasonably accurate in each instance—in presenting the records that appear in these articles.

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Leeds and Its Railways.

By S. P. THOMPSON.

LEEDS, the sixth largest city in England, with a population of approximately 500,000 persons, is a most important railway centre. Situated adjacent to the great Yorkshire coalfield, within easy reach of the important agricultural areas of the North and East Riding, and not too remote from the east and west coast ports, it is to-day the commercial metropolis of the West Riding. Of very ancient growth, it is fitting that the place should have been the scene of early railway development. So long ago as 1759, we learn of a railway or tramway utilised for carrying coals from the Middleton Collieries to Leeds, a distance of some three miles. It was along this tramway that just over one hundred years ago—1812 to be precise—Blenkinsop's engine "the first commercially successful locomotive used in England," hauled a train weighing something like 140 tons, composed of 38 wagons, at the marvellous speed, as it was then considered to be, of three-and-a-half miles an hour. Three similar locomotives were also subsequently constructed in Leeds, and worked on the tramway up to 1830.

Six important railways serve the city, the Great Northern, Lancashire and Yorkshire, London and North Western, Midland and North Eastern Companies. It is true the various goods and passenger stations cannot put forward any considerable claim to architectural beauty, yet they have been laid out on generous lines. The principal passenger stations in the city are three in number. The "New" station houses the North Eastern and London and North Western Companies' trains; Midland trains run into the "Wellington" station adjoining; and the "Central" station is the home of the Great Northern and Lancashire and Yorkshire Railways.

The Leeds and Selby line, constructed in 1834, was the first railway to convey passengers in the district, and one may be pardoned, therefore, in giving pride of place in any description of Leeds railways to the North Eastern Company, who subsequently took over this branch, more especially as the "New" station into which the Company work is the only through station in the city, and also the largest. Powers to erect the station were secured in 1865, and it was opened in April, 1867. On January 13th, 1892, a disastrous fire destroyed nearly the whole of the west end of the station, and the present complete edifice dates from the rebuilding following the conflagration.

Leeds forms the south-western limit of the North Eastern system, and two important lines, one to Selby, York and Hull in an easterly direction, and the other to Harrogate and the north, passing over some 40 chains of Midland line between Leeds Junction and Wortley Junction, connect the city with north-east England. Entrance to the New station is gained either from the City Square, or a little further east by way of New Station Street—railway property—from Boar Lane. Arriving at the station from the City Square, and passing the joint parcels offices of the North Eastern and London and North Western Railways, and the North Eastern District Superintendent's Offices on the left-hand side, entrance is obtained to the station proper. On the left-hand are located the booking offices of the North Eastern Company, while the London and North Western booking offices are situated directly opposite. The main circulating area is of liberal proportions, and is well-lit; an effective train indicator is provided in the centre for the guidance of passengers. There are ten platforms, of which Nos. 5, 6 and 7 are "through." Generally speaking, the North Eastern Railway uses platforms Nos. 5 to 10, and the London and North Western Railway Nos. 1 to 4, though the trains of both systems make use of the through platforms Nos. 5, 6 and 7. The station-master's office is built on the main platform. Various offices for inspectors, telegraph operators and the left-luggage staff are located in the same block as the London and North Western booking offices, *i.e.*, on the right-hand side of the main entrance. The block of buildings of which the North Eastern booking offices form a part also contains waiting rooms for ladies and gentlemen.

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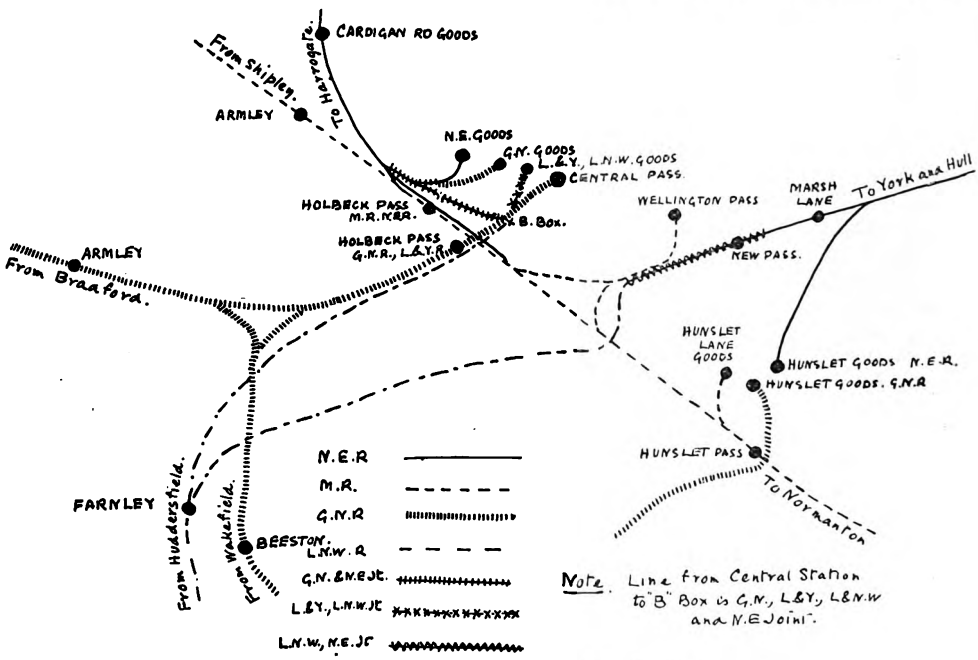
The refreshment and dining rooms are well-equipped and attract a considerable number of travellers. They front on to the main circulating area and platforms Nos. 2 and 3. The island platforms Nos. 6 and 7 are reached by means of a wide foot-bridge and incline from No. 5 platform. There is considerable geographical distribution of traffic at the station; trains for and from certain districts are dealt with regularly at one platform. This arrangement is, however, at times departed from to meet the exigencies of traffic. The New station is managed by a Joint Committee of the two owning companies, known as the Leeds New Station Joint Committee.

the 80 miles 11 chains between the two latter points are traversed in 89 min. The train, which is composed of up-to-date electrically-lit stock, vestibuled throughout with breakfast and luncheon car accommodation, is to-day the quickest by any route from Leeds to the Scottish capital. In the winter months, through coaches, detached at York, are conveyed by this train for Scarborough; during the summer-time these become unnecessary, as a through train from Leeds to the "Queen of Watering Places" departs immediately in the wake of the "Newcastle flier."

Important through services with other lines, *viâ* Leeds, New station, are (1) with



MAP OF RAILWAYS IN THE LEEDS DISTRICT.

The principal long-distance services maintained to and from the city by the North Eastern Railway are (1) with Newcastle, Edinburgh and Glasgow, *viâ* York; and (2) with Newcastle and Edinburgh, *viâ* Harrogate, over what is termed the "Leeds Northern line," which was amalgamated with the North Eastern Railway in 1854. The chief trains in these services are the 8.55 a.m. Leeds to Glasgow; the 5 p.m. from Glasgow (Queen Street) to Leeds; and the 9.40 a.m. train Leeds to Edinburgh, *viâ* Harrogate. The 8.55 a.m. express, *viâ* York, covers the 230 miles to Edinburgh in 4 hours 37 min., with stops at York and Newcastle;

Newcastle and Liverpool, London and North Western Railway; (2) Hull, Paragon station, and Liverpool, London and North Western Railway; (3) Scarborough with Manchester and Liverpool, London and North Western Railway; and (4) a through train between Scarborough and Bradford, Midland—non-stop Scarborough-Leeds and *vice versa*—each way. The two latter services are summer ones only.

The North Eastern Company possess the heaviest residential traffic of any railway serving Leeds. Harrogate and York, the Yorkshire coast watering places, and the smaller country towns and villages within a

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few miles of the city claim a very considerable number of regular passengers. In dealing with this "rush" traffic, the Company have, in the case of some of the shorter journeys, successfully employed steam auto-cars consisting of an engine with a passenger coach at either end for the conveyance of passengers between home and business, and *vice versa*; these give a quick service to and fro, and obviate the necessity for reversing operations at destination stations.

The Company's locomotive sheds and carriage sidings are situated at Neville Hill, some 1½ miles east of Leeds New station, and at busy times there is something approaching a continuous stream of rolling stock passing between the two places. An interesting feature in connection with the staff arrangements at the station is the provision of railway servants' coffee rooms, where railwaymen may obtain refreshment at a reasonable price. The building stands at the entrance to platform No. 1.

Railways serving Leeds cater for a very extensive excursion and holiday traffic, and in normal times the excursion, week-end, ten-day and tourist bookings to North Eastern resorts are often very heavy. Many thousands of passengers are booked to Bridlington, Scarborough, Whitby, Saltburn and other resorts, and at such times the New station presents a most animated scene. The North Eastern own an attractive publicity office in Commercial Street, the fashionable shopping centre of the city, where information relative to holiday resorts, train services and the like is furnished and tickets issued.

London and North Western principal passenger train services with the city are those to and from Manchester, Liverpool and North and South Wales. This Company's trains are also housed in the New station. The bookings to Llandudno and other popular Welsh coast holiday resorts are considerable during the season; this traffic has doubtless felt the benefit of the extensive North Wales publicity campaign which the Company have conducted.

An interesting phase of the traffic dealt with at the station in normal times is the frequent running of emigrant specials from Hull, North Eastern Railway, to Liverpool, London and North Western Railway, by way of Leeds. The heavy train loads of Continental emigrants *en route* to America formed a picture not likely to be soon erased from the mind. One can imagine the officials would heave a sigh of relief as the tail lamps of these trains, with their cosmopolitan freight, disappeared over the London and North Western metals in the distance.

MAIN CIRCULATING AREA, LEEDS "NEW" STATION.

"Wellington" (Midland) passenger terminus adjoins the New station, with which it is connected by a covered approach. It is of the closed type. Six platforms are provided, and as it is situated on the Midland main line, an excellent service of trains connects the city with the principal English and Scottish centres. There is also a considerable holiday traffic with Morecambe,

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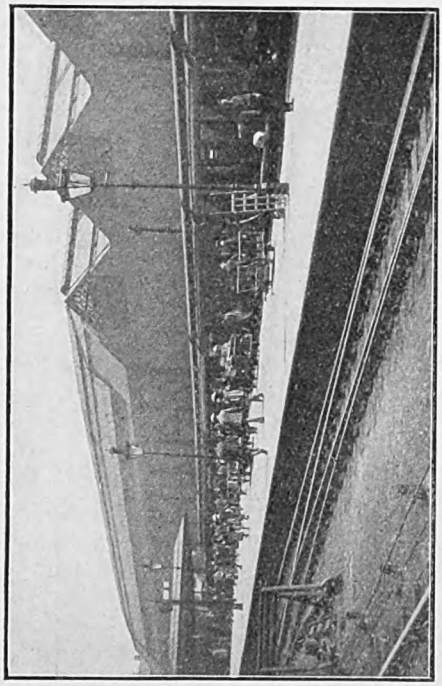
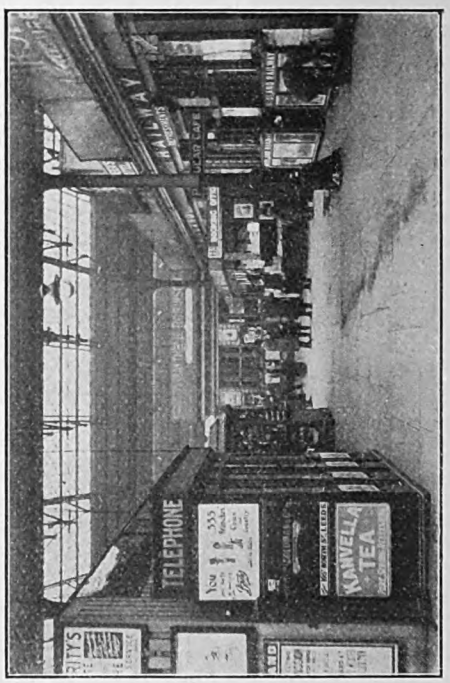
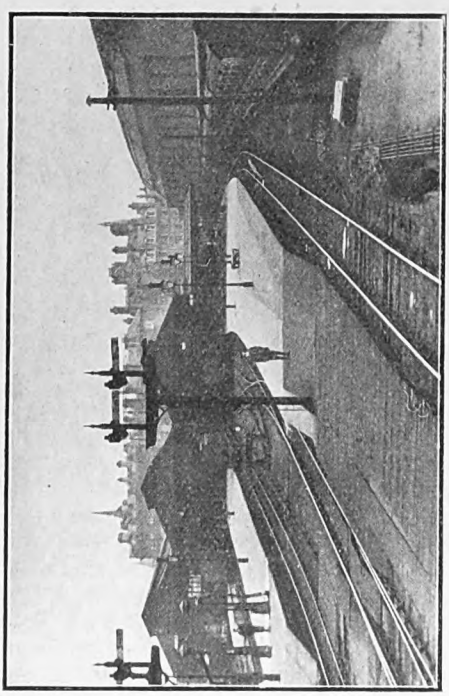


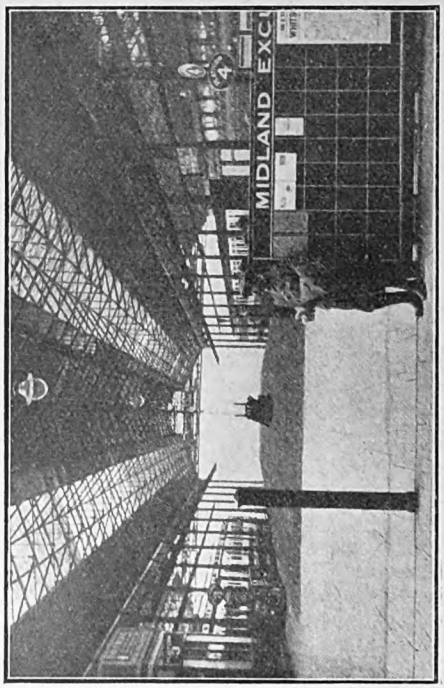
NOS. 1 & 2 PLATFORMS, ON ARRIVAL OF A TRAIN FROM DERBY.



PORTION OF CIRCULATING AREA.



GENERAL VIEW TAKEN FROM YARD.



NOS. 3 & 4 PLATFORMS.

WELLINGTON STATION, LEEDS: MIDLAND RAILWAY.

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Heysham (for Ireland and the Isle of Man), the English Lake District, and the south and west of England during the season. A number of the Lancashire and Yorkshire Railway Company's trains from Doncaster run into this station giving connections from Goole, etc. The district offices of the Company are located in the City Square—quite near to the station—and Messrs. Thos. Cook & Sons, passenger agents for the railway, own an attractive office in Boar Lane. Adjacent to the Midland station, and fronting on to the City Square, is located that Company's "Queen's Hotel," one of the most popular hotels in the city, and a recognised meeting place for commercial men.

Central station, which houses the Great Northern and Lancashire and Yorkshire Companies' trains, is situated in Wellington Street, about 400 yards distant from the other principal passenger stations, and is reached from the street either by way of a road running between the Great Northern Company's palatial hotel and the station at the east end, or by a staircase at its western extremity. The seven platforms, which are "closed," are, generally speaking, made use of by the trains of both Companies. Separate booking offices are provided for the issue of tickets to stations on the respective railways.

The Great Northern Railway route from Leeds to London is the shortest and quickest available, and the service is very popular with West Riding commercial men having business in the metropolis. All the principal trains as also those on the Midland route between Leeds and London, include restaurant cars. The quickest time for the run is provided by an up journey of 3 hours 25 min. for the 185¾ miles. In Doncaster race week many hundreds of followers of "the sport of kings" make their way to the "butter-scotch town" by the Great Northern route.

Lancashire and Yorkshire principal services are with Manchester, Liverpool, Southport and Blackpool, and the more important trains on this route are composed of up-to-date corridor stock with lavatory and refreshment car accommodation. At holiday times the ordinary trains for Blackpool are well filled, and in addition a considerable excursion traffic is catered for. The workers of the West Riding find in "Blackpool's bracing breezes" a splendid tonic. In the summer months through express trains are run to and from the Lincolnshire coast watering places (Skegness, Mablethorpe and Sutton-on-Sea), and to those on the Norfolk coast (Sheringham, Cromer, Yarmouth, etc.). Local services are given to Bradford (by express trains in 17 min.), Wakefield, Batley, Dewsbury, Morley, Gildersome, etc.

The Lancashire and Yorkshire and London and North Western Railways have a joint office at 140, Briggate, Leeds, which is extensively used for the issuing of tickets, dealing with parcels traffic and enquiry purposes.

The principal industries of the City of Leeds are iron and steel making, ironfounding, engineering, locomotive and wagon building, printing, woollen and worsted manufactures, tanning, boot and shoe making and chemical manufactures. The leading railway goods depôts are the North Eastern Railway's Wellington Street and Marsh Lane stations; the Wellington Street and Hunslet depôts of the Great Northern Railway; the stations of the London and North Western, and Lancashire and Yorkshire Companies in Wellington Street; and the Midland Company's Hunslet Lane depôt.

There is heavy North Eastern traffic with north-east England, the east coast ports and Scotland. In addition to general merchandise, the Company handles large consignments of live stock. The offices of the District Goods Manager and District Goods Agent adjoin the Wellington Street goods station. The goods warehouses here have been designed with a view to enabling traffic to be loaded and unloaded with a minimum of handling, and the lay-out of the sidings has also been conducted with a view to efficient working. It is interesting to note that a heavier tonnage of agricultural machinery and engines is forwarded from the station than from any other place on the North Eastern system. Approximately 4,000 tons of this particular traffic are despatched annually. Adjacent to the goods warehouses are situated the Company's grain and flour stores. Large quantities of these commodities are stocked.

Marsh Lane goods depôt (North Eastern Railway), at the other side of the city, east of the New station, also accounts for a very considerable tonnage of traffic. From this station an express goods service connects the city with Edinburgh, Glasgow and other Scotch centres. The Company also own goods stations at Cardigan Road and Hunslet, within the city boundary, and work to many sidings and works in the city. Among the latter may be mentioned the Leeds Forge Company's works, and the Monk Bridge

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LANCASHIRE AND YORKSHIRE AND LONDON AND NORTH WESTERN RAILWAY COMPANIES' TOWN OFFICE IN LEEDS.

Iron works. There is a very considerable exchange of traffic with the Great Northern, London and North Western and Midland Railways to and from the North Eastern system. Shipment goods to Hull, Middlesbrough, Hartlepool and the Tyne ports form no mean proportion of the North Eastern outward traffic dealt with at their stations. From these ports there are steamship services to practically all parts of the world.

The Great Northern Railway goods station is located about 200 yards east of the North Eastern depôt, and also fronts on to Wellington Street. The district goods and passenger offices of the railway are situated on the opposite side of Wellington Street to the passenger station. Large consignments of traffic to and from London and the principal centres of population served by the railway pass through the depôt, and various sidings linked up to the railway in and around Leeds help to swell the tonnage. Extensive storage accommodation under cover is available. The Hunslet depôt is most conveniently situated in the City for traffic to and from the market.

Adjacent to the Great Northern Railway goods station is situated the Lancashire and Yorkshire and London and North Western Companies' goods depôt and grain and Excise Bonding warehouse. The offices of the two railways are located in one block of buildings in Wellington Street, close to the goods station. The two lines have an extensive business both inward and outward in wagon-load traffic and smaller consignments, and in addition to their ordinary rail forwardings, despatch considerable quantities of merchandise to Ireland by their steamers from the west coast. They also deal with a very considerable shipping traffic for and from Liverpool, Manchester, Fleetwood, and the Humber.

To reach the Midland Railway depôt, one must make quite a considerable journey from the other goods stations, for it is situated in Hunslet Lane, half-a-mile south-east of the Wellington Street stations. The traffic conditions here are not markedly different from those existing at the other Leeds goods stations. Merchandise is received from and despatched to all parts of the kingdom, and the warehouse and storage accommodation is extensive. The Company also tap several of the more important works in and around the city by means of siding connections, and in addition deal with a heavy carted traffic.

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Railway Electrical Progress and Practice.

By "INDICATOR."

IN last month's article various applications of electrical working in reference to lifts, cranes and similar equipment in railway service were reviewed; but the subject is far from exhausted, and a few further examples of this branch of the subject will be in place.

Cranes of "walking" or "bicycle" type are used in many large railway warehouses, and an example, operated by electricity, is shown on page 54, constructed by Messrs. Ransomes and Rapier, Ltd. This crane is one of two supplied to the Cordoba Central Railway for use at the Alta Cordoba workshops. This one has a wheelbase of 10 ft. and a radius of 12 ft., and will lift 3 tons on a single part rope, the maximum height of lift being 10 ft. 3 in. The crane is arranged to turn around a substantial steel post provided with anti-friction rollers at the foot, and ball races and balls at the top. Three motors are provided, one for each motion, all being controlled from the driver's cage. Speeds provided for are: lifting 30 ft., travelling 150 ft., and turning 2½ revs. per minute. The other crane is of larger capacity, for 5 ton loads, and has corresponding altered dimensions. In this design there are two wheels running on a single rail, the necessary lateral support being obtained from guides above. Three motors are employed, one for lifting, one for travelling and one for turning and current is collected from overhead leads through collectors at the top of the crane. Appliances of this class are particularly useful in that a minimum travelling space is occupied, so that a very narrow passage-way is sufficient at ground level, the load itself travelling at a higher level where more space is usually available. These cranes can be arranged to operate through a complete circle, giving a maximum sphere of usefulness. When a design without balance-weight is employed the crane can travel close to a warehouse wall.

With the adoption of electric cranes a natural development is to use electric capstans, and for many conditions these are superior in economy and speed to hydraulic equipment. The second illustration shows an electric capstan supplied by Messrs. Ransomes and Rapier to the Buenos Ayres and Pacific Railway. It will exert a pull of 2 tons at a speed of 150 ft. per minute. Motor and gear are contained in a cast-iron box, special attention being given to making both the main and hand covers watertight to suit semi-tropical conditions. The capstan head is driven by a double-pitch worm, with ball thrust bearings placed in an oil case, driving a worm wheel with a phosphor bronze rim. The motor is of 30 B.H.P., suitable for three-phase current. The controller is operated by a foot pedal, and in addition there is provided a special three-speed arrangement with dashpot, worked by a foot plunger.

Reference has already been made to the use of overhead runways, but the third illustration shows an adaptation of the same system to operate on an endless rope. This was supplied to the Rhodesia Railways as part of a conveyor equipment. It will lift a load of 10 tons at 20 ft. per minute on a four-part rope and travels along a steel wire cable at 200 ft. per minute. Both travelling wheels are driven by spur gear by means of a friction-clutch when the lifting gear is disengaged, and one 25 B.H.P. direct current motor operates both lifting and travelling gears. An automatic electric brake is fitted to hold the load, and the driver can also apply the brake by means of a foot lever. The whole construction is made as light as possible and weighs only 5 tons. Current is taken from a bare copper wire, the return passing through the cable.

The fourth illustration shows a 1½ ton electric platform crane, also supplied by Messrs. Ransomes and Rapier, Ltd., for use at the Canon's Marsh goods depôt, Great Western Railway. It has a radius of 15 ft., and provides for a lift of 13 ft. There is a motor for each motion, the controllers being combined so that the movement of the handle corresponds with that of the load. An electric brake is fitted to the load gear, and a foot-brake to the turning gear. The crane turns on a post carried by a cast iron baseplate bolted to a concrete block foundation, current being taken into the crane through the

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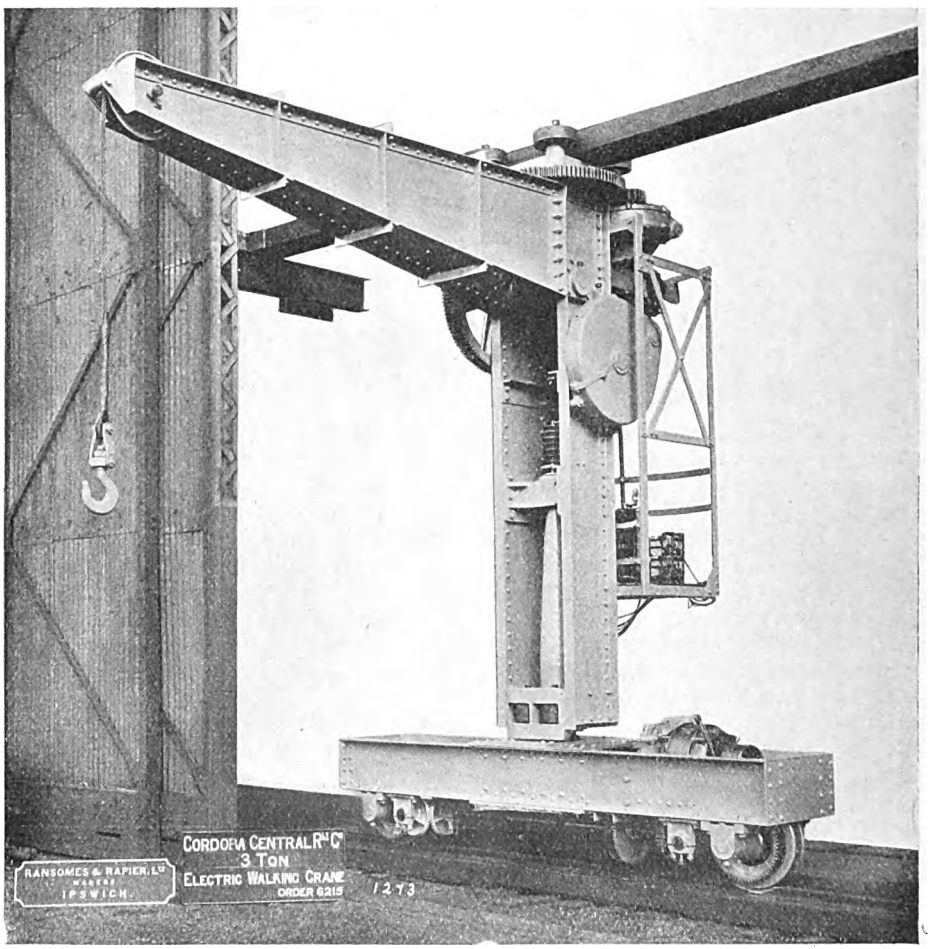
lower part of the post. Lifting speed with full load is 55 ft. per minute, and turning speed is $3\frac{3}{4}$ revs. per minute.

While on this subject reference may also be made to several special types of electric crane and lifting machinery. The fifth illustration shows an underhung crane supplied by Messrs. Royce, Ltd., for use at the Great Western Railway goods depôt at Moor Street, Birmingham. The special advantage of this type of crane is that the whole of the space below the crane is available for manœuvring. It is in effect an overhead crane, but combines the function of a radius jib crane movable longitudinally along the building, and having a radius which may extend outside the limits of the overhead tracks. The usefulness of this type of crane will be manifest from the view reproduced.

There are 4 motors, one for travelling the whole equipment; one for traversing the underhung crane along its supporting frame; one for turning and one for lifting. As this example is intended for dealing with general goods traffic a capacity of 1 ton is more than sufficient.

But electric power is also used for high capacity cranes, and a good example of a special equipment of this class is the electric cantilever goliath crane shown on page 59. This is of a travelling gantry type, but the cantilever extensions increase the scope of loading and transverse traversing, the load being raised or lowered even to the extremes of the cantilever arms and being adapted to pass between the towers to the further end if required.

This crane was supplied to the order of



ELECTRIC WALKING CRANE FOR THE CORDOBA CENTRAL RAILWAY.

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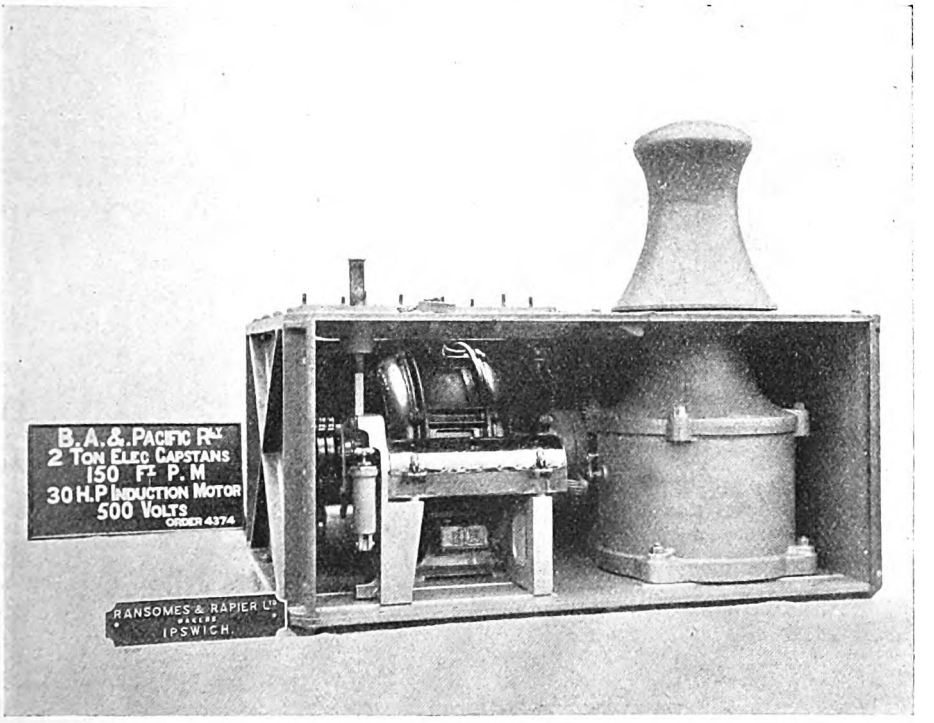
the High Commissioner for the Union of South Africa for use in one of the goods yards attached to the South African Government Railways. It will handle up to 35 tons on the centre span and 8 tons on the cantilevers. The crab is arranged with main and auxiliary barrels, provided with 8 and 4 part steel wire ropes respectively, each winding two parts. Overall length of the girders is 108 ft.; the range of crab-travel is 92 ft.; gauge centre to centre of legs is 52 ft.; and the headroom under the girders is 25 ft. 2 in. The crane travels upon eight steel tyred wheels, mounted upon volute springs, two wheels on each side being driven. Height of lift is 22 ft. for the main lift and 24 ft. for the auxiliary lift.

All motions are performed by electric power, controlled from the driver's cage, which is swung beneath the crab. Lifting 35 tons from the main barrel the speed is 10 ft. per minute, or 20 ft. with lighter loads. Lifting 8 tons from the auxiliary barrel speed is 30 ft. per minute, or up to 60 ft. with higher loads. Traversing speed is 100 ft. per minute, and travelling speed 122 ft. per minute. For test purposes the crane was able to lift 42 tons.

The ordinary overhead yard crane deals with the load entirely between the supports, but in some cases a cantilever extension is provided at one or both ends and all the work may be done on the extension, design being, of course, adapted to conditions and requirements. In the case of overhead cranes of all types it follows from the mere fact that they are usually of considerable, and frequently of exceptional load capacity, that unless they can also be used as "general-utility" machines, or they are installed under conditions which call for their almost continuous use, they will not be required for lengthy periods. When that is so it follows that steam power can hardly be economical, whereas by using electricity current is always available and the crane can be used as required without preparation or left alone without cost. It is largely for this reason, though other factors also call for attention, that electric power is extending so widely into lifting machinery practice.

Moreover, whereas a few years ago, the general opinion was that where a large power plant is concerned and there is justification for a hydraulic pumping and



2-TON ELECTRIC CAPSTAN: BUENOS AYRES AND PACIFIC RAILWAY.

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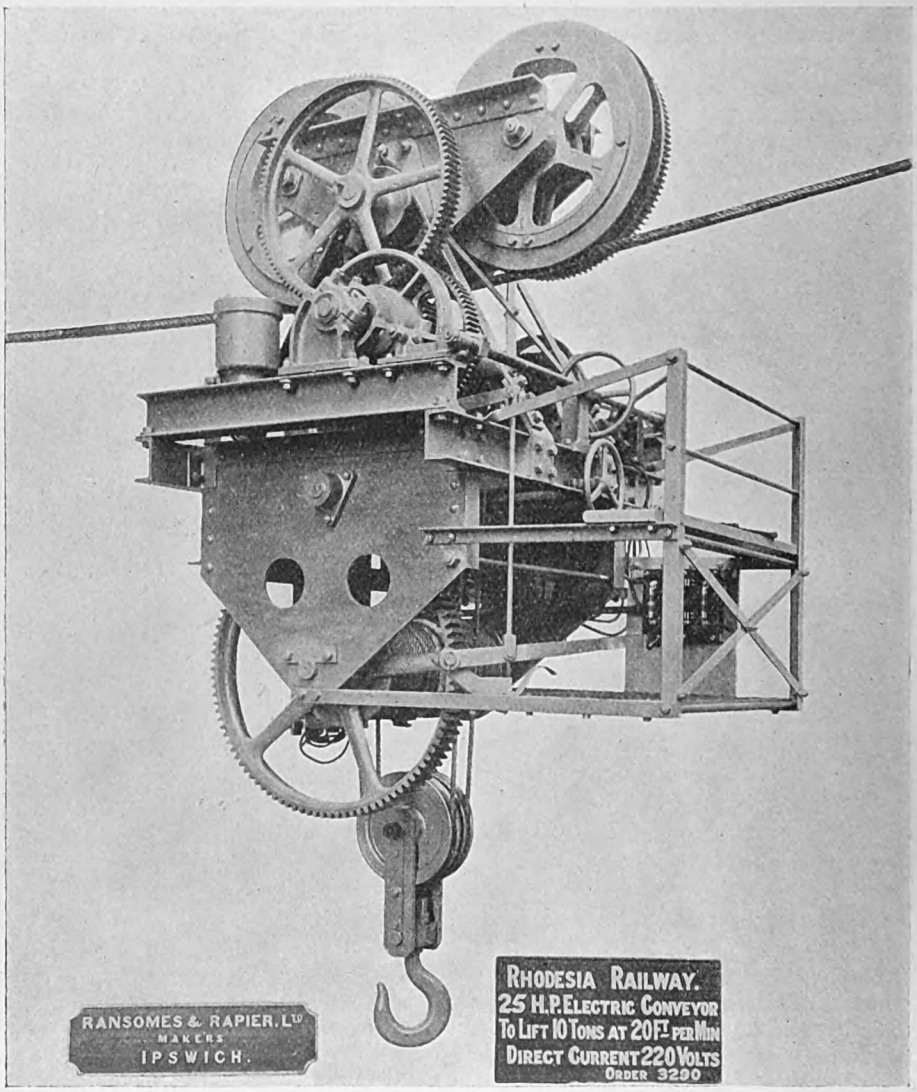
accumulator station, or hydraulic power is conveniently available, the most satisfactory course is to instal hydraulic cranes, electricity is now extensively used. Thus at many of the more recently equipped docks and wharves, including those belonging to railways, we find that high-power cranes, travelling crane, for current is now so generally available at moderate cost, and up-keep staffs are now familiar with electrical machines, that the electric crane proves satisfactory in all ways, in regard to initial, operating and maintenance costs, and also because of convenience.



10-TON ELECTRIC TRANSPORTER: RHODESIA RAILWAYS.

as well as many other appliances are operated electrically, and that the result is justifiable not only in respect of power capacity and the meeting of working conditions, but also on an economic basis. Electricity is also seriously menacing the ordinary steam

Thus we find that ordinary types of electric cranes are being used more and more generally, while many of the coaling and wharf cranes found in railway and other docks are as large as, or even larger than, types of steam and hydraulic cranes

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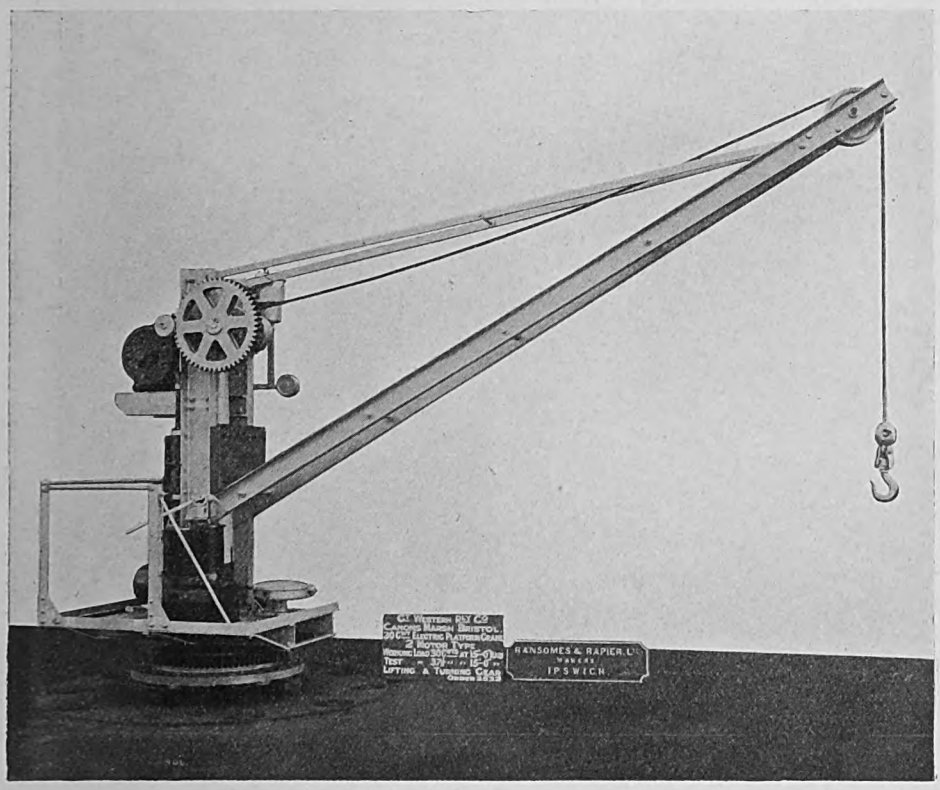
which have hitherto been most general for such uses. Last month reference was made to certain large-capacity Royce cranes installed at recently constructed railway docks, notably at the King George Dock, Hull, and the Great Central Immingham Docks; and many other examples could be cited, from the works of Messrs. Royce and also of Messrs. Ransomes & Rapier, Ltd., besides other firms engaged in this branch of electrical industry.

Taking a few examples of Ransomes and Rapier cranes, the writer has before him particulars of an electric travelling jib crane of unusual type, which will lift 30 tons at 27 ft. fixed radius and through a height of 40 ft.; of a large travelling wharf and derricking crane, of the class in which the crane is mounted on a travelling base, which will deal with 20 tons at 42 ft. 6 in. radius, the height from rails to the jib head pulley being 80 ft.; and of a heavy electric travelling wharf crane supplied to the Buenos Ayres Great Southern Railway, and which is mounted on six pairs of wheels placed in two equalising frames to distribute the load and avoid concentrated pressures, this being adapted for dealing with 20 ton loads at 30 ft. radius, the available height of lift being 55 ft.

Usual types of wharf cranes are placed on carriages adapted so that wagons can pass between the legs, the crane itself being placed on a platform above. In many of the later Ransomes and Rapier cranes a free-barrel appliance is fitted by which the load can be lowered at any moment without stopping the motor. With this arrangement the operator simply moves the controller handle into the desired position for lifting, standing or lowering, as in the case of a reversing motor when a free barrel is not employed. The operator does not here have to use a foot brake for each lowering operation, yet the load is never allowed to fall freely unless the controller handle is placed in the position to cause this result. This materially expedites working, though at the



1½-TON ELECTRIC PLATFORM CRANE, INSTALLED AT CANON'S MARSH GOODS DEPOT, BRISTOL, GREAT WESTERN RAILWAY.

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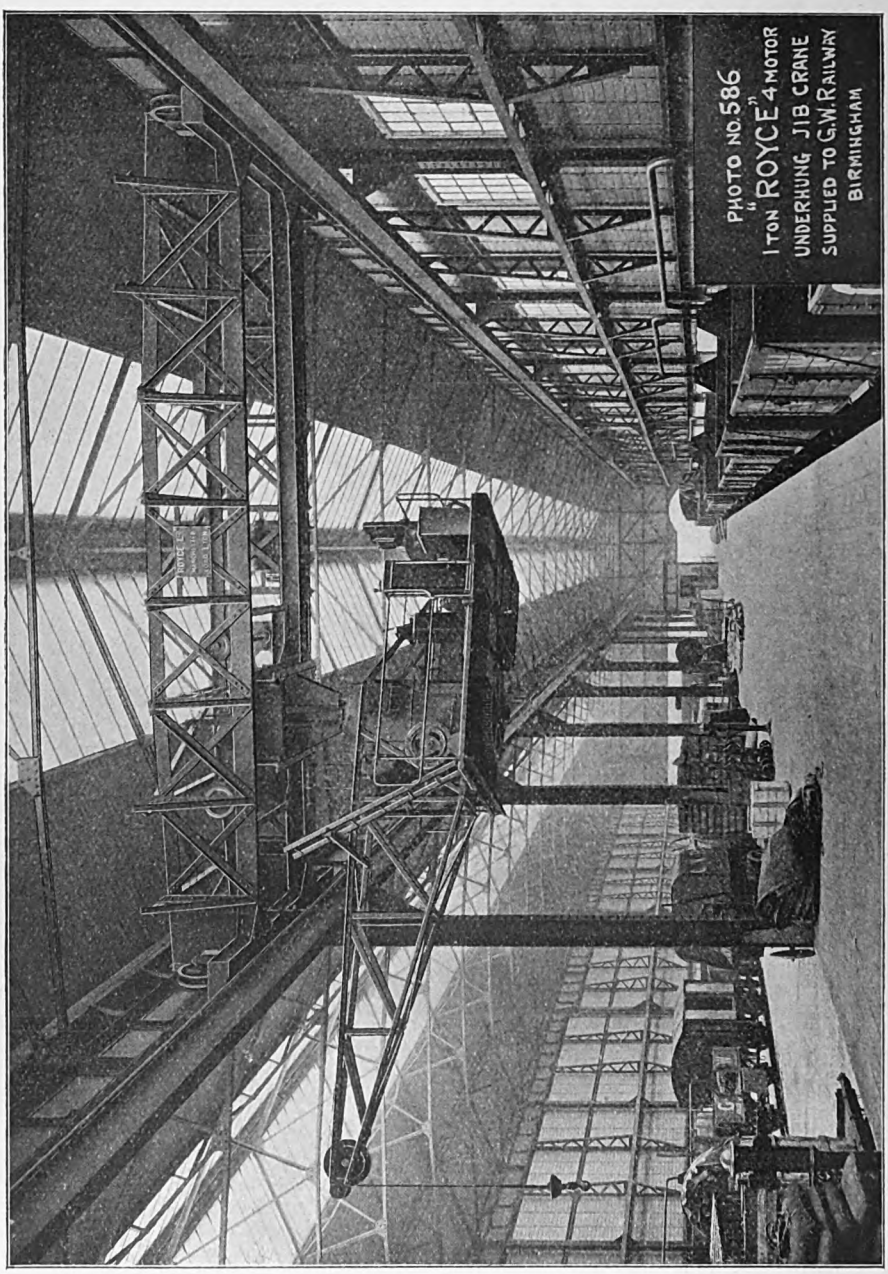

1-TON UNDERHUNG ELECTRIC JIB CRANE USED AT MOOR STREET GOODS DEPÔT, BIRMINGHAM, GREAT WESTERN RAILWAY.

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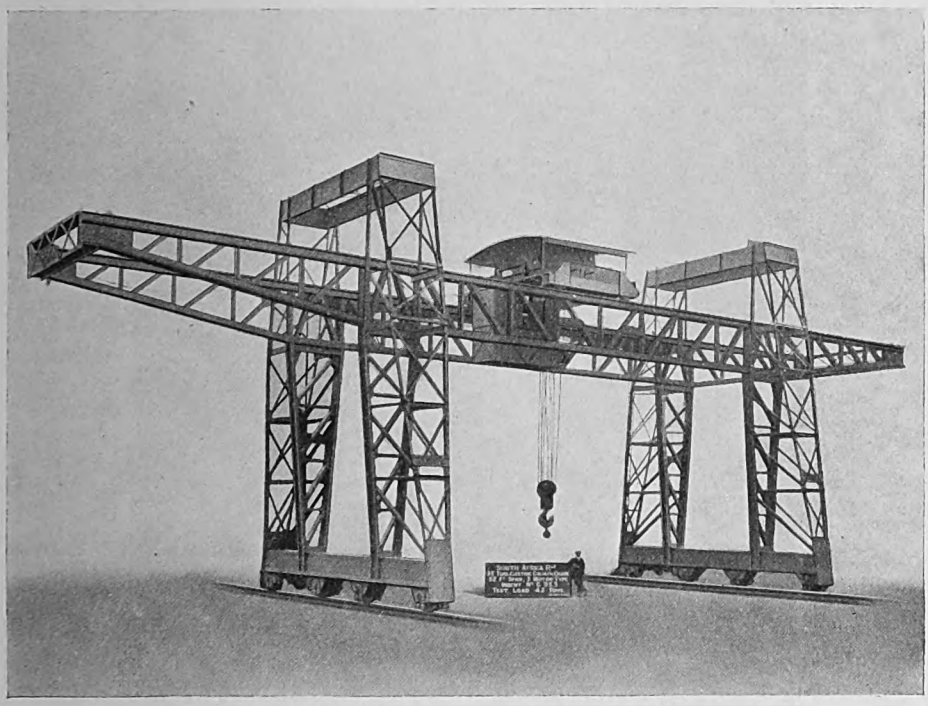
same time the makers point out that in dealing with general loading and unloading of cargoes of vessels alongside a wharf the measure of the work which can be handled is the time occupied by the men getting the goods ready for slinging, so that there may be little advantage in providing a crane which can work its cycle in less time than the goods can be got ready for it.

Another form of crane which finds considerable acceptance is the transporter type, wherein the crab travels to and fro along a projecting arm, this arm, sometimes of considerable length, being carried on a travelling frame and itself being, if required, adapted for radial movement. Such cranes may be placed on top of a warehouse or other building and load direct from vessels or railway wagons alongside, but at a much lower level. In one example loads of 2½ tons can be dealt with at a maximum reach of 82 ft.; a horizontal travel of 78 ft. is provided for, and the vertical range is 94 ft., the crane being adapted to load at one position and while the load is being lifted to travel to another position. In some cases electric cranes are constructed to run on top of the gable roofs of warehouses and other buildings, the main frame running on one rail at parapet level and the other at the top of, or some way up, the gable roof.

Other applications of electric power for lifting and traversing purposes are as foundry and ladle cranes, smithy cranes, and for general ship purposes, and many of these, including exceptional types, are found in railway shops.

Besides lifting and traversing applications of crane type, electricity is finding considerable favour for conveying appliances, as used in warehouses, granaries and coaling plants. Thus, the coaling plant installed by the London and North Western Railway at Crewe includes an electric tippler for emptying coal wagons—turning them bodily over—and for conveying the coal from rail level to the bunkers; and in many other coaling plants similar facilities are included, according to requirements. In granaries, too, it is usual to employ electrically actuated elevators for lifting grain from ships' holds into the silos, while for horizontal transfer conveyer bands are frequently employed.



35-TON ELECTRIC CANTILEVER GOLIATH CRANE FOR THE SOUTH AFRICAN GOVERNMENT RAILWAYS.

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THE RAILWAY PORTRAIT GALLERY.

SIR WILLIAM FORBES,

General Manager,

London, Brighton and South Coast Railway.

Lieutenant-Colonel, Engineer and Railway Staff Corps.

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KNIGHTHOOD FOR LIEUTENANT-COLONEL FORBES.

Birthday Honour for the London, Brighton and South Coast Railway General Manager.

MOST popular in British railwaydom and far beyond its circles was the honour of knighthood conferred by His Majesty the King upon Lieutenant-Colonel Forbes, General Manager, London, Brighton and South Coast Railway, and a member of the Railway Executive Committee.

Born in Dublin in 1856, the new knight, henceforward to be known as Sir William Forbes, was son of the then General Manager of the Midland Great Western Railway. Educated at Dulwich and on the Continent, he began railway life in 1873 under his uncle, the late Mr. James Staats Forbes, at that time General Manager of the London, Chatham and Dover Railway.

Commencing in the goods department the future distinguished railway officer passed through every branch of the service dealing with the transportation of merchandise. Then came experience in the Accountant's office followed by a period as Travelling Auditor.

Appointed Continental Manager in 1889, all the arrangements of the London, Chatham and Dover Railway in connection with the Paris Exhibition of that year were carried out by him with great success. Afterwards he became Traffic Manager of the London, Chatham and Dover Railway, and in that position remained until the working arrangements with the South Eastern Railway in 1898 came into operation.

In 1899 the position of General Manager of the London, Brighton and South Coast Railway was offered to and accepted by Mr. Forbes. Here he found wide scope for improvements and to their promotion his energy was persistently applied. Briefly stated these innovations have been the deviation line from Coulsdon to Earlswood; the re-construction of Victoria Station, London; extension of Pullman services; improvements in train services between the Midlands and North of England and the Sussex Coast, and motor train services on certain sections of the Brighton Company's line.

Under Mr. Forbes' *regime* immense strides have been made in the Continental services—working in peace time is of course under comment and not present conditions—more and better cross-channel steamers have been employed and the train services on the French side have been improved.

In the Metropolitan area Sir William Forbes is well-known in connection with the electrification of the South London lines. The electrical services were commenced in 1909 and at once obtained a great popularity.

As a member of the Railway Executive Committee, Sir William Forbes has performed work the value of which to the nation can only be truly gauged by expert observers. Suffice it to say that while the staff of the London, Brighton and South Coast Railway keenly appreciate the honour paid their chief officer they are likewise extremely proud of his connection with the Railway Executive Committee.

Sir William Forbes is an officer of the French Legion of Honour, an officer of the Belgian Order of Leopold, and a Knight of the Danish Order of Dannebrog. He has taken his turn as Chairman of the General Managers' Conference of the Railway Clearing House, and is well-known in the Parliamentary Committee rooms as a witness of no mean merit on railway administration questions. He is Lieutenant-Colonel and Commanding Officer of the Engineer and Railway Staff Corps.

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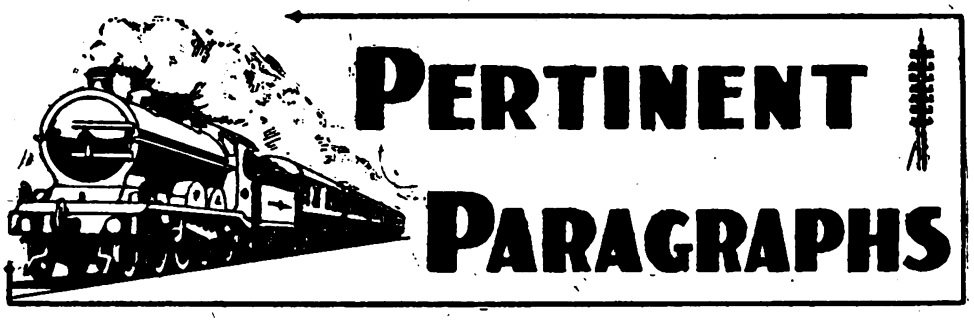

Our July Plates.

WITH this number of the RAILWAY MAGAZINE two plates are given, one presenting a portrait of Sir Herbert Ashcombe Walker, General Manager, London and South Western Railway, and Acting Chairman, Railway Executive Committee, and the other being a correct colour plate showing a South Eastern and Chatham Railway express train. The former is of special interest in connection with the first article of this issue, which it faces. The latter is prepared on the basis of a photograph taken by Mr. W. H. C. Kelland near Grove Park, the train being then travelling at about 60 miles per hour on the up fast line. The engine is one of the large superheater class built by Messrs. Beyer Peacock and Co., Ltd., of which a colour plate was presented with the December, 1914, RAILWAY MAGAZINE.

Summer Train Services.

THIS month the RAILWAY MAGAZINE commences it thirty-seventh volume, having been published continuously since July, 1897; but for the first time for many years past the July issue does not contain an article reviewing the "Summer Train Services" which are to apply during the holiday season, with particular reference to specially noteworthy train innovations and new facilities. This year, however, nothing of that kind could even be contemplated. Our nation has for nearly twelve months been engaged in war; and our railways are being operated as if they were national property, though administered by a Committee of General Managers. War Office requirements, therefore, come first, and whatever privileges may be given to the general traveller, although even a partial resumption of cheap fares now appears somewhat doubtful, everyone realises that this is not the time for developing train services or offering new facilities. At the same time, and unless untoward developments in the national situation arise, there is little doubt that there will be a considerable volume of additional travel during the summer months. Many people will be journeying from the great towns to seaside resorts, and largely to places of interest inland, in order to obtain a few days rest, and for the benefit of wives and children; and this is understood by the railway companies. As a rule the winter time tables are being worked upon, with a few added and relief trains to meet anticipated requirements. A few items of interest as to the arrangements which will apply on varying dates in July are referred to in following paragraphs.

London and North Western Railway.

ON this line the new time tables will operate from July 12th. Several usual summer rearrangements of trains will be made as far as the anticipated traffic renders them desirable, especially as affecting travel from London, Birmingham, Liverpool and Manchester and other busy towns to Llandudno and the North Wales coast, and to Blackpool. Thus the 10.30 a.m. from Birmingham to Crewe will run on Mondays, Fridays and Saturdays only, July 12th to 24th inclusive, then daily until August 28th, and on Mondays, Fridays and Saturdays only from August 30th to September 27th inclusive, and will convey vehicles for North Wales and Blackpool. Similarly the 9.50 a.m. from Leicester to Nuneaton will be extended to Blackpool on Mondays, Fridays and Saturdays only, July 12th to 24th inclusive, daily to August 14th, and on Mondays and Saturdays only, August 16th to September 27th; while it will convey North Wales vehicles also on Mondays, Fridays and Saturdays only, July 12th to 24th, daily to August 28th, and on Mondays, Fridays and Saturdays only, August 30th to September 27th. The 11.2 a.m. train from Bletchley to Blackpool will also run, exchanging with the 10.10 a.m. from Euston at Stafford. The 11 a.m. from Euston will again be a Cambrian Coast, Central Wales and Windermere and Keswick express; while there will be at 11.20 a.m. a North Wales express calling at Northampton only to Crewe. The Stranraer through carriages and sleeping saloons will continue to travel by the 8 p.m. *ex*-Euston; while the 8.50 p.m. will become a direct Scottish express, with a new 9 p.m. from Euston to Northampton, Rugby, Coventry, and Birmingham. Through carriages between London and Inverness will continue to be operated on alternate nights by the East and West Coast routes. In the opposite direction there will, of course, be corresponding arrangements. In addition several of the usual summer trains will reappear, altered a little in some cases, or running only on certain days of the week instead of daily. On the whole the London and North Western Railway arrangements suggests that all is to be done that appears likely to justify itself, and that the summer services will not be so destitute of special attractiveness as was at one time expected would be the case.

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Cambrian Railways.

A CONSIDERABLE number of tourists are expected to visit the Cardigan Bay resorts during the coming season, and the Cambrian Railways Company are preparing for these by putting on a full service of trains, and making arrangements in conjunction with the London and North Western, Great Western and other companies for the running of through carriages from the large industrial centres, including London, Birmingham, Wolverhampton, Liverpool, Manchester, Cardiff, Merthyr, etc. The company hope to have completed early in July two observation cars which will be used on the Coast line, and which will afford tourists an opportunity of viewing the unrivalled scenery through which the line passes. The facilities in conjunction with the issue of holiday contract tickets available over 50 miles of Coast line for any number of journeys for the small sum of 7s. per week should be a great attraction to this district. A further inducement to visitors, is the fact that at the present time the district is quite removed from the possibilities of enemy air raids.

North Staffordshire Railway.

DURING the summer months there will be a through service between Derby and Aberystwyth leaving the former station at 9.8 a.m., the return service being 12.55 p.m. from Aberystwyth on Mondays and Saturdays, July 26th to August 28th inclusive. A through train will also leave Derby at 11.5 a.m. for North Wales, returning from Llandudno at 4.30 p.m. daily. The 3.3 p.m. Stoke to Llandudno (2.5 p.m. from Derby, Saturdays) and the 1.35 p.m. from Llandudno to Derby will also give a through service between the North Staffordshire district and the North Wales Coast. There will also be through vehicles on the 11.30 a.m. Llandudno to the North Staffordshire line July 26th to August 28th inclusive to meet the accommodation of travellers.

Great Northern Railway (Ireland).

As far as this Company is concerned the general arrangements will be similar to previous seasons. The express train services between Dublin, Belfast, and Bundoran will come into operation for the season on July 1st. The new features will consist of the following:—The 9 a.m. express train from Dublin to Belfast will be accelerated to arrive in Belfast at 11.40 a.m.—20 minutes earlier than at present. Through carriages will run between Dublin and Portrush (Midland N.C.C.) *viâ* Antrim, on weekdays for the accommodation of holiday parties, from Dublin by the 9 a.m. train, and from Portrush by the 11.20 a.m. train. A motor car service has been established between Warrenpoint railway station and Rostrevor, taking the place of the old tramway.

Dublin and South Eastern Railway.

ALTHOUGH excursion arrangements are not in force on the English and Scotch railways, Mr. A. G. Reid, General Manager, has arranged to give these facilities, and to continue the popular "Go as you please" tickets. Attractive arrangements have been made to enable travellers to visit the far-famed Valley of Glendalough and the other beauty spots in County Wicklow by the provision of combined tickets for rail, coach and hotel. These consist of eight-day contract tickets issued at first class, 20s.; second class, 15s.; third class, 10s., on presentation of tickets from any English, Welsh, or Scotch station. These contract tickets entitle the holder to travel an unlimited number of journeys over the Dublin and South Eastern Railway. These lines give access to one of the most attractive tourist districts in Ireland, and contract ticket holders may visit any station on the system as frequently as they may find convenient during the period of availability. Amongst others the following places may be specially mentioned:—Kingstown, Bray, Wicklow, Rathnew, Rathdrum, Avoca, Woodenbridge (the Balmoral of Ireland), Gorey, Wexford, New Ross, and Waterford. There are golf courses at Bray, Greystones, Wicklow and Woodenbridge.

Great Central Railway.

THERE are virtually no special developments this summer, but we may note the convenient facilities offered for traffic to Stratford-on-Avon, both from London and from Manchester, Liverpool, Bradford, Sheffield, and the North generally; and the comprehensive cross-country restaurant car services *viâ* Banbury and Oxford, giving direct connection between the Midlands and the northern cities and the coast resorts served by the Great Western and London and South Western Railway. Good facilities are also afforded from London and from Midland towns to Southport and other places on the Lancashire coast, including also the Wirral Peninsula, *viâ* Liverpool. A few alterations will be made in the suburban services.

Midland Great Western Railway.

ON this line it is not contemplated to introduce any novel changes this summer, merely reverting to last year's service with slight modifications. The morning express to the West will be timed to leave Broadstone at 10.30 a.m. as in 1914, the arrival times on the main line and Clifden, Mayo and Sligo branches being practically unaltered.

Furness Railway.

THE summer train service on the Furness Railway will come into operation on July 12th, and in common with all other railway companies, it will not be on such an elaborate scale as in other years. This, of course, is consequent on the great European War, and the necessary curtailment of cheap excursion tickets. However, tourist tickets are still to be obtained, and visitors to the beautiful English Lake District will find that this enterprising Company have fully anticipated their wants in providing an

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excellent service of trains, with through carriages from London, Liverpool, Manchester, Leeds, etc. It will also be a great source of satisfaction to intending passengers to the delightful places served by this railway to know that the now famous "Tours Thro' Lakeland" by train, steam yacht and char-a-banc can be made every week-day.

Caledonian Railway.

TIME-TABLES issued June 14th are intended to continue until September 11th and during that period an amplified service is provided. This service is smaller than that usually in force during the summer months and it is principally due to the withdrawal of excursion bookings. Most of the standard services are maintained, including the important residential trains to and from the large centres. No new services are being introduced. Many of the popular Highland tours are being maintained, such as the famous Trossachs and Loch Lomond tour, Loch Tay tour, Lanark and Falls of Clyde, Oban, Crieff and Balquhidder *viâ* Callander or Gleneagles, etc.

On the Firth of Clyde an excellent steamer service is being provided from Wemyss Bay, Gourock and Ardrossan piers.

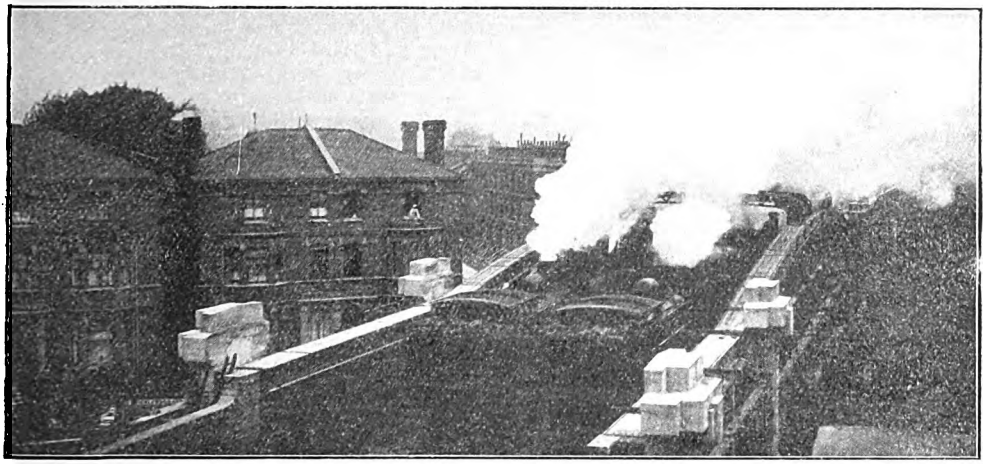
During the summer a Pullman observation buffet car will be in service between Glasgow and Oban, leaving Glasgow (Buchanan Street station) with the 8 a.m. express and returning from Oban to Glasgow the same evening by the 4.15 p.m. train. Pullman cars are likewise maintained on other services, *viz.*, between Glasgow (Central) and Edinburgh (Princes Street) by all the express trains, and between Glasgow (Buchanan Street), Perth and Aberdeen, leaving Glasgow 7.30 a.m., 10 a.m. and 5 p.m., returning from Aberdeen 10.5 a.m., 1.10 p.m. and 5.30 p.m.

Other Railways.

THERE is no occasion to deal in detail with arrangements made by other railways. In most cases the timetables appear in a reduced form, largely owing to the withdrawal of pages concerned with special facilities, excursions and matters necessarily non-applicable, seeing that cheap fares are not at present in operation. In some instances the standard winter schedules are adopted as a basis, amplified as considered desirable; in others a modified summer timetable is issued, with a number of the usual special services on routes which call for them. The Irish lines are the only ones which cover excursion and cheap fare arrangements, and circular and other special tours.

Completion of Widening Works, Metropolitan Railway.

ON Sunday, May 30th, the Kilburn Viaduct and the series of notable bridges required to complete the widening works in progress on the Metropolitan Railway between Finchley Road and Wembley Park, were officially inspected, and on Monday, May 31st, "fast" traffic commenced to be worked entirely over the new lines. The connection between the fast and the slow lines just beyond West Hampstead terminal sidings was taken out entirely, and now all trains using the fast lines remain thereon from Finchley Road to Wembley Park. Trains can still transfer from slow to fast at Willesden Green, Neasden and Wembley Park; but there are no usual connections from "fast" to "slow" in the down direction. The "fast" lines have platforms at Willesden Green, Neasden and Wembley Park, so that many semi-fast trains can also be run over them. The new lines are equipped with automatic signals, on the upper quadrant principle, as on the older sections. Further developments in the numerous fast services already provided between the favourite and healthy residential districts served by the Metropolitan trains, may therefore, be effected, and the completion of this four-track work will benefit considerably the already large numbers of business people who reside in the Harrow, Uxbridge, and Chiltern Hill districts,



TESTING THE NEW KILBURN VIADUCT BRIDGE, METROPOLITAN RAILWAY.

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a country which is almost unsurpassed for scenic beauty and healthful surroundings, and which is served by numerous fast trains to and from Baker Street, a large number being continued directly through to Liverpool Street or Aldgate, so as to bring passengers into the heart of the City.

A photograph is reproduced showing the testing of the Kilburn Viaduct Bridge. The illustration shows eight locomotives, four on each set of rails running together, and weighing over 400 tons.

The Gretna Disaster.

SATURDAY, May 22nd, was the blackest day in British railway history, for on that morning occurred what is, by far, the worst railway accident the United Kingdom has known, while the death-roll, double that of the Armagh accident, which previously held the record, included mainly members of His Majesty's forces travelling in connection with their military duties. The scene was Quintinshill sidings, Caledonian Railway, north of Gretna, and just over the boundary between England and Scotland; and the trains concerned were the midnight sleeping-car express from Euston for Glasgow, running late (4–4–0 engines Nos. 140 and 48); the 6.10 a.m. stopping train from Carlisle to Beattock (4–6–0 engine No. 907), and a troop special from Larbert (4–4–0 engine No. 121); while a goods train in the siding at Quintinshill also suffered, though it was not actually involved in the accident, except that its presence in the siding, together with the occupancy of a loop on the other side by another goods train, rendered it necessary to shunt the stopping train to the up main line to allow the express to pass.

Early accounts of the accident were contradictory, and until Col. Druitt opened his inquiry at Carlisle on May 26th it was difficult to understand what had really happened. Apparently, the local had been shunted on to the up line to allow the express to pass, and forgotten by the signalman, with the result that the troop special ran into it at full speed, and a moment or two later the express collided with the débris. The horrors of fire were added, as to which it must be left for Col. Druitt to ascertain the cause. Including subsequent deaths the total is now, it is understood, 168, with some 200 injured, all the deaths except three, and nearly all the cases of serious injury, being of soldiers attached to the 7th Royal Scots Regiment, most of them travelling in the troop special but including several officers travelling as ordinary passengers in the express train.

The evidence at the Board of Trade enquiry revealed all the essential facts, but as this has been reported fully in the daily newspapers, there is no need for further comment here, though we shall deal with the points raised when Lieut.-Col. Druitt issues his official report. As a sequel to this terrible accident James Tinsley, the signalman primarily concerned, was arrested at Dumfries a few days later, on a charge of culpable homicide and of causing the death of the driver and fireman of the troop train and of three officers.

Railway Enthusiasts in His Majesty's Forces.

How much the RAILWAY MAGAZINE is appreciated by the British wounded has been commented upon by the honorary secretary of the War Library, and quoted in these columns, but at the office of the magazine direct evidence of the popularity of railway literature in the fleet, war camps and trenches, to say nothing of the naval and military hospitals, comes to hand daily in the form of orders for railway books, railway photographs and postcards and the magazine itself.

Our correspondence proves that in spite of the excitements of war railway enthusiasts do not forget their love of the locomotive and all that surrounds its operations. For instance, a reader writes to say that he has enlisted and wishes to take with him a picture of his favourite Great Western Railway locomotive, "Queen Mary." Another from a military depôt "somewhere in Kent" expresses appreciation of the June number and remarks very kindly, "the RAILWAY MAGAZINE is one of the few publications that does not issue second-rate matter and blame the war!"

In sending for a second set of the popular Mackay railway postcards a private in the 1st British Columbia's says: "I am a member of the 1st Canadian Contingent. I had both bones in my left leg broken by a shell whilst in the trenches near Ypres, but am getting along fine now. The RAILWAY MAGAZINE is sent to me every month by friends. Although not in any way connected with railways I am very interested in all railway affairs and like to keep in touch with what is going on. I find the RAILWAY MAGAZINE an excellent medium."

Needless to say, we are always delighted to hear from readers serving with the Colours and proud to find that even the great war cannot divert their fidelity from their favourite magazine.

Readers not serving in the fighting forces cannot do better than send their copies to friends in khaki or in navy blue. Back or current numbers for the use of soldiers in the war camps may be sent in carriage paid parcels to the Camps Library, 22, Earl Street, Westminster, London, S.W., and for the hospitals to the War Library, Surrey House, Marble Arch, London. In the latter case care should be taken to send only quite unsoiled copies.

In addition to thousands in camps and hospitals interested in railways as a hobby, there are large numbers of men who in civil life were railway workers and these we are assured by the Secretary of the War Library keenly appreciate the RAILWAY MAGAZINE.

Auto Trains.

REFERRING to "Voyageur's" articles under this title, we are informed that certain remarks

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made in reference to rail motor-cars on the Barry Railway are now inaccurate. The two motor-cars built for this Company have been converted into bogie coaches by removing the engines from the cars and utilising the additional space thus obtained for the accommodation of passengers. These two converted coaches, with a corridor connection, are now being utilised as a train on the Vale of Glamorgan section of the line, and accommodation is provided altogether for 12 first, 12 second, and 112 third class passengers, in addition to the luggage and guard's compartments at each end. The train is usually worked by a 2–4–2 engine, but there is no arrangement for driving except on the foot-plate.

A Bath reader points out that as far as his own experience goes—confined entirely to the Bristol and Swindon district—he has never seen Great Western tank engines of the 2–4–0 type employed on auto-train services. In every case auto-trains east of Bristol are worked by the 0–4–2 type, which are slightly smaller. On the Bristol suburban services 0–6–0 saddle tanks work sets of bogie coaches.

"J.S.B." also writes in reference to the same articles as follows: "I notice that 'Voyageur' on 'Auto-Trains' in the May RAILWAY MAGAZINE says 'the two companies using 0–4–4 type engines are the North Eastern and the Midland.' I should like to point out that (since Christmas, 1914, I believe) the South Eastern and Chatham Railway have had in use on the Moorgate Street–Brixton service three auto-trains made up as follows:—A 0–4–4 type tank engine, a 6-wheeled coach (5 third class compartments), a coach with 1 third and 3 first class, and a vehicle with 3 second class and the driver's compartment. The engines used would, I believe, compete with the Midland 0–4–4's for the honour of being 'the largest and most powerful in use for auto-working.' Similar trains are used on the Crystal Palace line on Sundays, and are occasionally to be found on the Nunhead–Greenwich Park service instead of the more usually employed 0–6–0 tanks (with two bogie coaches) mentioned by 'Voyageur.'"

Locomotive and Train Working under War Conditions.

REFERENCE has been made incidentally on several occasions to unusual journeys made by locomotives and rolling stock under war conditions, and one of our contributors, Mr. Philip F. Groves, writes suggesting that it would be of interest if readers would send in particulars of such unusual features as they may have noted, with a view to publication as far as consideration of what is advisable or not under present conditions will allow. He mentions several examples which he has himself observed. Even though troop trains were concerned, in connection with which some special features might be expected, it would be hard to beat the following. He writes: "In April I was at Eastleigh station on the London and South Western Railway for 15 minutes only, and in that time saw a train composed entirely of London, Brighton and South Coast stock, engine and all; a North Eastern train hauled by a Great Western locomotive of the "Pendennis Castle" type; and a London and North Western train hauled by a "Flower" class engine of the Great Western Railway. But this was far excelled on the following day, on which date I was near Swaythling station (two miles east of Eastleigh) for 45 minutes. There I saw a Great Eastern Railway empty train hauled by a 0–6–0 goods locomotive pass a loaded troop train proceeding to Southampton hauled by a 4–4–0 rebuilt locomotive of the same railway. It would be interesting to know if any other readers have seen two trains of the same railway pass each other at a point 75 miles from the nearest place (London in this case) on the system of the owning company. After these Great Eastern trains came the Great Western engine *Begonia* on a London and North Western train, with which she returned in 33 minutes, turned round so as to run chimney first as she had run to Southampton. Truly a smart piece of work. Then followed a South Eastern and Chatham train hauled by No. 772, the first of the Borsig built express engines owned by this company."

The Value of Railways in Time of War.

AN essay on this subject, by Mr. H. G. Smith, General Superintendent's Office, Midland Railway, Derby, won the first prize in a competition instituted by the Midland Railway Literary and Debating Society. After briefly reviewing the development of military aspects of railway utilisation, the author sets out in broad outline the necessary conditions and factors governing their advantageous utilisation, as follows:—

(1) Necessity for collective and central control of all railways in any area or country for military and civil purposes in time of war.

(2) Transport of troops, equipment, munitions of war, and wounded.

(3) Utilisation of railway works, plant, appliances and resources for purposes other than apply in peace times.

(4) Railways as strategic factors.

He then discusses these headings in detail. In the first place, it is impossible to emphasise too strongly the necessity for collective and central control, especially in a war of such magnitude as the present one. Prince Bismarck realised this after the Franco-German War, and whilst seeing the immense possibilities of earning revenue from the State ownership of Prussian railways, he saw also most clearly the importance of a unified railway system as a means of transport for military purposes. The Government of France provided forty years ago a permanent military organisation which should always have in readiness a scheme whereby in case of war the existing railways could be placed under a central control in order to utilise all means of transportation for the benefit of the State, military needs, of course, taking

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precedence. Russia, too, is an example where, although the railways are not owned by the State, the Government exercises a strict control for military purposes in time of war.

In Great Britain, with its privately-owned railway system, the present crisis brought into being for the first time a comprehensive and direct State control, exercised through the Railway Executive Committee, a body composed of railway general managers. This State control was not an emergency arrangement, but was provided for under section 16 of the Regulation of the Forces Act of 1871. Experience of the working of the Railway Executive Committee's control has shown its efficacy. The most exacting military requirements in matters of transport have been met and with little interference to the working of traffic for the business community. Certain passenger and merchandise services have been curtailed, but without causing much dislocation or complaint.

Troop Transport.

In the second place comes the actual transportation of troops, equipment, munitions of war, and wounded men. The successful execution of this depends largely upon the efficacy of the control referred to in the previous section. And unless the military and naval authorities can rely upon an expeditious, definite, and regular transport service their plans for operations in the field and on the seas are nullified. Hence a country possessing a railway system which in its essentials—gauge, rolling stock, and signalling—is standardised, has an ally of the greatest utility. Germany is well provided in this respect, and her preparations include also the lettering of all rolling stock, with particulars of carrying capacity in terms of men, horses, and guns; trains to carry a certain quantity of men and materials can thus easily be made up at any point. The French and Belgian State Railways in their turn have made arrangements for requisitioning at short notice rolling stock of certain types suitable for conveying armies.

Great Britain, with its private ownership of railways, has in many respects a standard which the companies have followed, largely as the result of voluntary conferences at the Railway Clearing House.

All British railways have telegraph and telephone services connecting all stations, thus enabling headquarters to get into touch with any point at short notice, and altered methods of signalling and working in emergencies can easily be arranged. The "Control" system of working traffic enables special arrangements to be made quickly.

The competitive system under which railways in this country have been managed in the past has resulted in a high state of working efficiency being obtained, with the object naturally of providing a quick and certain transport service for revenue purposes; and with this end in view engines, stock, permanent way, and other equipment have been kept in good order, more so, perhaps, than under a complete State management. The Order in Council providing for the control of the Railway Executive Committee, therefore, put into their hands an instrument of high efficiency and capacity for the military requirements.

"War Time-tables."

For many years past the trunk railways have had in existence a "War Time-table," kept up to date, for the working of troop trains from chosen centres after mobilisation of the forces. To some extent also the movement of troops at manœuvres in various parts of the country annually has provided useful experiments in the matter of loading, conveyance, and unloading of large bodies of men with their equipment. In August last, therefore, the "War Time-table" came into operation with the ease of clockwork, and it is common knowledge how smoothly and quickly the Expeditionary Force was transported to the South Coast.

In a similarly rapid manner the German, French and Russian Armies were conveyed to their destinations. Actual fighting consequently took place in an incredibly short time after the declaration of hostilities, and (but for circumstances which need not be entered into here) the Germans would have scored an undoubted success—probably victory in the western area—thanks to the efficiency of their rail transport services.

Then, again, an efficient railway system is of great value for drawing the wounded from the fighting lines and thus leaving the combatant forces free in their movements and plans. Specially-designed and equipped ambulance trains are now a recognised feature in this country and on the Continent; and apart from other considerations are valuable aids to the quick recovery of wounded men; the latter can be distributed quickly to hospitals all over the country instead of overcrowding the base hospitals, and when convalescent the men can easily reach their homes for recuperation. This knowledge that quick treatment can be obtained no doubt improves the morale of the men. In Russia it has been found possible to equip trains with baths for the men to use after a spell in the trenches, an innovation which improves the health of the troops.

Further advantages accrue from the utilisation of railway locomotive and carriage works for the manufacture of articles required by the military authorities. The large staffs of engineers, artisans, and trained men of various trades in railway "shops" were available for the making of military road vehicles, guns, munitions, electrical machinery, motors, telephones, pumps, stretchers, and equipment of every description. Cross-channel steamers belonging to railway companies were of use in the transport work, and the docks provided by railway companies for their own requirements in normal times have been of great advantage for military purposes. Railway hotels at different points being conveniently situated for the treatment of wounded

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have been turned into military hospitals, because their proximity to stations ensures a minimum of handling from train to bed. Then, again, the cartage equipment of the railway companies was at hand for use by the military, and motor vans, lorries, horses, barrows, etc., were speedily requisitioned on the outbreak of war.

Railways as strategic factors.

The last factor is that of railways for strategic purposes. In this country there is not probably a purely strategic railway, due no doubt to the system of privately-owned lines on a competitive working basis. The trunk lines running north and south present opportunities for alternative routes in case one or more were temporarily rendered unworkable ; but it may be said that strategical reasons were not considered when they were constructed. The Continent does, however, present examples of railways built with consideration for military purposes. Russia, for instance, adopted the unusual plan of having a gauge different from that of neighbouring European countries, in order to secure greater immunity from attack ; this necessitates a change of trains at the frontier, with obvious advantages from a military point of view, though there is a disadvantage in this when the Russian Army crosses the frontier and has to transport its material on foreign soil.

Germany, in turn, has dealt with its railways in a scientific way for military reasons. There may not be many lines built for purely military purposes ; more often certain main lines have been doubled, tripled, and even quadrupled to selected points on the frontier, thus making the railway capable of dealing with an amount of traffic hardly ever likely to be carried in normal times. In combination with these multiple tracks large sidings were laid down at convenient places for military mobilisation needs. The benefit of these so-called "strategic" railways has been proved by the way in which the German commanders have been able alternately to increase the violence of the offensive on the western and eastern fronts. In France and Belgium are a number of semi-strategic lines which enable troops to be readily transferred from one main system to another.

Of course, the destruction of certain sections of railway in a district where armies are operating may have a vital strategic utility, but unless care is taken this destruction by the advancing party may recoil with disastrous effect in case a retreat is afterwards necessary. Undoubtedly, railways can be included as strategic factors in military tactics with advantage. In conclusion, it may be stated that the railways have had a supreme test from which they have emerged triumphantly, and their value in time of war has been abundantly proved.

Egyptian Railways and the War.

THE Egyptian State Railways have been playing a very prominent part in connection with recent events in Egypt, and we are indebted to *The Indian Railway Gazette* for particulars of certain features of what has been done. The British Government decided that, as in accordance with the Suez Canal Convention the Canal ports of Suez and Port Said were neutral, no more troops should be landed at them than were necessary to secure the safety of these places. All other troops brought into Egypt, British Territorials, Australians, Tasmanians, New Zealanders, men from Ceylon, etc., have been landed at the Mediterranean port of Alexandria, which has also been used for the reception of wounded Indians from France. On the Egyptian State Railways has fallen the work of the transporting these troops, well over a hundred thousand in number, and their baggage to their various destinations, either up to the Suez Canal or to the various garrison towns of Egypt, Cairo, Zagazig, etc. In addition to the men, of course, have been the thousand and one items of traffic which accompany an army, artillery, wireless telegraphy installations, field and base hospitals, fodder, stores and munitions of war generally. Few people have, in fact, been aware of what the railways have done because nearly all movements of troops have been made at night. So secretly, indeed, have these been carried out that not infrequently the very driver of a troop train when starting out had no idea of his destination, merely receiving orders at one station to proceed to the next as he went along.

It is, however, in connection with the defence of the Suez Canal against the Ottoman-cum-German attack that the State Railways of Egypt have played the most important part. From Cairo to Zagazig, 82 kilometres, the line is double, thence to Ismailia, 79 kilometres, it is single, and also following the Canal bank. Along this single line of railway, served by another single line from the base established at Zagazig to Ismailia, the successful British defence of Egypt was based. Until within recent years, the line from Port Said to Ismailia was a narrow gauge (75 centimetres) one, the property of and operated by, the Suez Canal Company. Subsequently, it was purchased by the Government of Egypt, and converted to the standard Egyptian gauge, 4 feet 8½ inches. Even when the present war started, however, the crossing places in the single line all along the Canal were few and far between. This was speedily remedied, however, and some eleven loops, each capable of accommodating a train of maximum length, were put in by the State Railway Engineers, in almost record time. The result of this was that not only was the administration able to handle all military traffic expeditiously and without congestion but the ordinary passenger time table has been worked to without a hitch, and even public goods traffic has only been stopped once for one day only, that upon which the Turkish attack (and debacle) actually took place.

War Work at the State Railway Workshops.

FOR weeks before, the workshops of the State Railways at Boulac, Cairo, had been working

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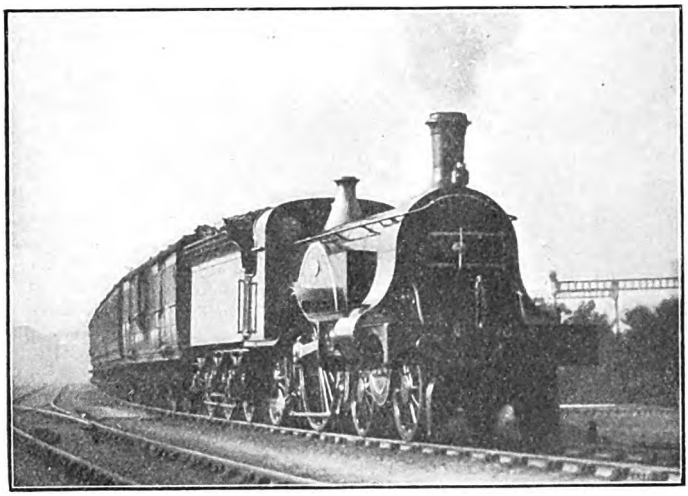

Photo] [P. W. Pilcher.

"THE LAST POST."

8 ft. Single, No. 1003, on slow train near Boston.

day and night on military requirements. Hundreds of iron bedsteads for the use of the troops were turned out; three or four completely equipped hospital trains, a rake of armoured trucks fitted with searchlights and two or three armoured trains form a portion of the works these shops have been responsible for under the direction of Mr. Peckitt, the Chief Mechanical Engineer. The searchlight trucks and armoured trains have continually patrolled the line along the Canal bank, with a military crew, a State Railway locomotive officer on the engine and a Traffic officer acting as guard. Throughout the period preceding the attack, and for some days afterwards, the more important stations were directly in charge of European railway officers specially deputed from other parts of Egypt for the purpose. Fortunately, the Turkish bombardment was so ineffectual that the railway escaped practically without injury. The Suez Canal Company's station of El-Ferdan, 13 kilometres north of Ismailia, was badly damaged, and the railway station at the same place slightly so—that was all. Now that all danger (if ever there was any) to Egypt itself is over, the Egyptian State Railways still continue to play an important part in the war. Every night long troop trains go rumbling through the darkness. One day a camp is busy and humming with life. The next it is nearly silent.

Rolling Stock Facts and Figures.

THE new system of railway accounts and returns renders available many statistical details not hitherto accessible, not the least interesting of which are those of railway rolling stock. In the 1915 *Railway Year Book* some of these details are collected and presented in tabular form, these new tables constituting one of the special features of the current volume; and our contemporary, the *Railway News*, has gone still further, with a series of articles classifying and summarising rolling stock statistics in a way only possible in the pages of a weekly publication. In conclusion a lengthy summary table shows that on 120 railways there are now no fewer than 24,818 locomotives, of which 93 are electric; while for coaching traffic 79,539 vehicles are available. On the goods side there are 759,910 vehicles, while for service use the number is 49,629. The Midland Railway possesses the largest number of tender locomotives (2,260); the Great Western heads the list of tank engines with 1,698; but as regards gross totals the Great Western (3,084), London and North Western (3,068) and Midland (3,014) Railways may be said to tie for leading place, their figures being relatively so close together. As was to be expected the City and South London Railway provides the largest total of electric locomotives, 45 of the grand total of 93, the Metropolitan coming next with 21. In respect of passenger carrying vehicles, the London and North Western leads with 6,161, taking also first place as regards other coaching vehicles (3,351), and for the grand total (9,532); the Great Western taking second place with a record of 8,836 of all classes. For electric vehicles first place goes to the London Electric Railway with 488, followed by the Metropolitan District with 454 and the Metropolitan, where steam stock is also in considerable use, with 418. The Great Western Railway has the largest number of rail motor cars, 100. As regards goods and mineral vehicles the Midland and North Eastern Railways claim the largest totals, respectively, 119,326 and 117,258, the Great Western coming next with 76,189, and the London and North Western with 75,687. Of the service vehicles the Great Western Railway is responsible for 7,543.

Locomotive and Train Working in the latter part of the 19th Century.

THAT Mr. Ahrons' articles under this heading are widely appreciated is shown by the continual stream of correspondence created thereby. Some of these letters merely support or challenge statements made, or ask for further information on specific points; but here and there a correspondent writes on lines which render his communication of general interest, and we may

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quote from a letter received from Mr. F. H. Alexander, of Newcastle-on-Tyne, as follows:

"During the years Mr. Ahrons refers to I was living near Hemsworth on the Great Northern Railway line between Leeds and Doncaster and took many opportunities of seeing the trains and engines he mentions. To see the numbers of the coupled engines stationed at Leeds (page 448) and the picture of No. 224 (page 451) is like meeting old friends. When I first knew No. 299 she had a cab like No. 6 (illustrated on page 448) but with the circular hole in the side open. In the late 'seventies the Great Northern Railway used Smith's vacuum brake, non-automatic, and many engines had the double ejector shown on No. 6; but later, and for the automatic form of the brake, the single ejector (No. 262, page 452) was used. The 8-foot singles had a fine bold curve to the pipe which was placed over the right hand cylinder. All the early singles had fan-shaped radial holes in the driving wheel splashers, and these were open until about 1884, I believe, when a sheet was placed behind them, and subsequent engines had plain sheets like No. 238 (page 450).

"I often saw the afternoon "flyer" (3¾ hours) from Leeds (dep. 2.30), and never remember its being horsed by an "8-footer"; I distinctly remember seeing No. 55 and No. 236 and once No. 92 on that train. I occasionally took a run from Wakefield to Doncaster on the 5.30 p.m. *ex*-Leeds, and in May, 1885, I obtained the following fast timing with No. 549 (8-footer) and four six-wheel coaches:

		M. S.
Wakefield	dep.	0 0
Nostell	pass	7.34
Hemsworth	,,	10. 8*
S. Elmsall	,,	12.51
Carcroft and Adwick ..	,,	16.34
Doncaster	arr.	21.28†
	stop	22.15‡

"I fully endorse what Mr. Ahrons says about the discomfort of the six-wheel coaches of those days, and felt it on that occasion emphasised by our speed passing Hampole, which I made out to be about 75 miles an hour. It is possible that Mr. Ahrons will refer in his next article to the Manchester–King's Cross "4¼ hour flyers" put on in 1884. [This is the case, as will be seen on reference to Mr. Ahrons' article this month.—Ed. R. M.] In January, 1887, I travelled in the up train leaving Manchester (London Road) at 2 p.m. and obtained the following timing, which contained one item specially noteworthy, namely, *the covering of over* 60 *miles in less than even time.* This feat is often accomplished now-a-days, but must have been remarkably seldom met with in those days.

		M. S.
Grantham	dep.	0. 0
Great Ponton	pass	7. 6
Top of Bank	,,	9.38§
Corby	,,	12.27
Peterborough .. (slow)	,,	31.48
St. Neots	,,	57. 5
Biggleswade	,,	67.28
(Sharp check by signal.)		
Arlesey	,,	72.41
(Check at 85.15.)		
Hatfield	,,	96.23
Southgate .. { passed slow / after check }		109.36
(Several applications of brake.)		
King's Cross	stop	118.50

Great Northern Railway engine No. 665 (8-footer).

"A long delay in Sheffield (8¾ minutes) caused a late arrival at Grantham. It is to be noted that the booked time from Grantham to King's Cross was 1 hour 58 minutes, and that there are very few trains of the present day timed as fast on that route. The Great Northern Railway engine No. 665 was illustrated in your issue of May, 1903 (page 398). The distance from Great Ponton to Biggleswade is 61 miles and the time taken by this train was 60 minutes 22 seconds, which I think was a noteworthy feat at that date, although the load was so light (*viz.*, four six-wheelers). There was a check ¼-mile beyond Biggleswade station, which put an end to the sustained high speed, and the subsequent frequent checks prevented the time lost north of Grantham from being made up, and added 50 seconds to the time allowed from there to King's Cross.

"My timing in those days was done with an ordinary watch, but as near the "seconds" as I could observe. I have worked with a stop-watch for the last 10 years, and have many records of good performances. I have not, however, succeeded in getting anything very *sensational*, such as speeds of over 90 miles an hour. The above refers to a date when fewer records were available and they may be of interest to Mr. Ahrons himself and perhaps to others of your readers."

In reference to this letter Mr. Ahrons writes: "Mr. F. H. Alexander is quite correct. I remember 299 well with the cab like No. 6. The engine No. 236 referred to on the Leeds afternoon special express must have been the rebuilt 7 ft. *Sturrock*. The 7 ft. 6 in. single 236 was not built until some years afterwards."

* Old station some few hundred yards north of present one.

† Platform end.

‡ Actual stop.

§ Top of Bank is probably Stoke Box.

A proposed "Quadruplex" Locomotive.

If the Erie 2-8-8-8-2 locomotive, illustrated in the Railway Magazine for July, 1914, is a "triplex" locomotive, then the engine referred to at the conclusion of a paper read before the New York Railroad Club by Mr. G. R. Henderson, consulting engineer, Baldwin Locomotive Works, and which is to be of the 2-8-8-8-8-2 type, is a "quadruplex" engine.

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Seeing that the famous Erie engine, with three sets of eight-coupled wheels, ranks as the largest locomotive in the world, it is difficult to conceive what an engine with four sets, sixteen drivers on each side, will be like, or for what duty even an American road can contemplate its employment. However, if the scheme is practicable no doubt it will be realised in due course. The location of the cab at the front end appears a necessity of the situation. Presumably the boiler will accommodate sixteen of the thirty-two coupled wheels, the other sixteen being below the tender. Mr. Henderson also mentioned the 100 locomotives which the Baldwin Locomotive Works have built for the French Government. They are small engines, weighing about 14 tons each, with firebox in the centre and a chimney at each end. From this description we gather that they are small articulated locomotives of "Fairlie" or similar type, intended for working on roughly laid tracks, and adapted for duties such as maintaining supplies and moving munitions on Military lines.

Wireless Signalling on the London and South Western Railway.

SOME two years ago a trial of the "Prentice" system of wireless signalling was made on a small scale on the Hampton Court branch of the London and South Western Railway. Since then the trial track has been considerably extended, and modifications of the system introduced to conform it to English railway conditions, and at the present time experiments on a much larger scale are being carried out by the inventors, with the concurrence and assistance of the London and South Western Railway.

Along the track, midway between the rails, runs a copper wire highly charged with electricity, which in normal conditions of "safety" continuously gives off a succession of electrical waves. Although the wire is boarded over and properly protected, the waves penetrate the casing and also any fall of snow or ice that might be lying upon it. This electrical wire is divided into sections corresponding with the ordinary signalling sections, and the arrangement is such that upon a train entering into one section, the section immediately at the rear becomes dead, *i.e.*, the wire loses its supply of current, and cannot emit the waves. The engines working over the trial track are fitted with a receiver in the shape of a length of copper wire running beneath the centre of the engine from end to end, and directly over the electrical wire in the track, but separated by a distance of about 12 in.

Should the track wire be alive, *i.e.*, normally clear of danger, the waves from it are absorbed by the receiver on the engine as it proceeds, and they have the effect of keeping the brakes of the engine and train off, and indicating by a semaphore in the engine cab that the road is clear. Immediately, however, the engine enters a "dead" section, the audible signal sounds a warning to the driver, the semaphore signal in the cab goes to danger, and the air brake automatically opening by gravity, applies the brake and stops the train, even though the steam may be full on.

The driver then, in order to proceed, must hold up the air brake valve with his finger, which will enable him to proceed to the end of the section, all which time the phonophore will be audibly warning him that the section ahead is blocked. If by the time he reaches the end of the section the line ahead is clear, a pick-up on the track will be energised, and throw the coherer into communication with the main wave wire, closing the valve, stopping the audible signal, and putting the semaphore to "all clear," so that the train can proceed under normal conditions. Should the section ahead not be clear, it would be impossible for the train to proceed unless the driver deliberately disregarded the phonophore and semaphore warnings and continued to hold up the air brake valve.

The salient feature of the system is that there is no physical connection between the track and the engine, the wireless wave from the track wire operating the apparatus on the engine. In the event of there being any failure connected with the apparatus, the instruments immediately give the "*danger*" warning.

Railway Train Photographs.

WHEN six months ago in response to appeals from RAILWAY MAGAZINE readers it was decided to publish a series of the famous F. E. Mackay railway train photographs in postcard form, bearing in mind the popularity of the work of the world's most expert railway photographer, it was expected the demand would be a large one, but the actual result has exceeded all anticipations. From China, Japan, Canada, United States of America, South America and Australasia to say nothing of the trenches on the Franco-Belgian war frontier and the military and naval hospitals in France and Great Britain have come orders and repeat orders for these popular cards. The success of the venture has encouraged the publishers to considerably enlarge the series, and a list will be sent post free to all applicants. Prices of cards in the new series range the same as the first edition, viz., single cards at publishers, 2d. each; by post, 3d. Six cards, post free, 1s. 1d., or twelve cards, post free, 2s.

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DURING the recent visit of His Majesty the King to Newcastle-on-Tyne he bestowed the Distinguished Conduct Medal on Private E. H. Gratton, of the 1st Leicestershire Regiment, for conspicuous gallantry under fire in October last. The official notice of the award states :—" His Majesty the King has been pleased to approve of the grant of the Medal for Distinguished Conduct in the Field to Private E. H. Gratton, 7430, 1st Battalion Leicestershire Regiment, for conspicuous gallantry on October 25th near Rue de Bois, when he brought up ammunition under a heavy fire from the enemy, who were at a distance of only 30 yards. He behaved with much gallantry on another occasion the same day." Prior to the war Gratton was employed as a porter at the Derby Goods station, Great Northern Railway, and joined the Colours as an Army Reservist at the outset of the War. Owing to his wound he has now been discharged from the Army, and, being unfit for further railway service, he has obtained a position as attendant at the Derby Library.

* * *

WITH the opening by the Great Western Railway of the " Neath Loop " for goods train traffic on May 9th, the completion of a further section of the Swansea District Railways scheme was effected. The loop is approximately half-a-mile in length and connects the recently-constructed railway between Llangennech and Briton Ferry Road with the Rhondda and Swansea Bay Railway at Dynevor Junction, adjacent to the Neath River Bridge. By means of this loop it will be possible to divert through trains not booked to call at Neath from the old main line to the new route *viâ* Dynevor Junction, and thence over the Rhondda and Swansea Bay Railway to Court Sart, where the Great Western line is rejoined. The use of the alternative route will considerably relieve the working of traffic through the Neath district.

* * *

OUR contemporary, *Engineering*, describes a smart piece of work carried out by the Royal Engineers at the front. It was completed entirely, from start to finish, in ten days, and it could not have been obtained from England in less time. The work was in the hands of the 109th Company, and was done with only such tools as are ordinarily available. Odd lengths of 75-lb. rail, which otherwise would probably have been wasted, were utilised. To cause as few joints as possible, and so to obtain rigidity, the wing rails, or cheeks, to the outer crossings are carried through in one piece until they form half of the frog at the centre of the middle diamond crossing. These frogs are cleated for strength with bent fish-plates in the acute angle made by the two pieces of rail which form the one frog. Flat-bottomed rails were used and bedded on ¾-in. plate, and screwed down to it in all cases with coach screws. Over 250 holes had to be drilled. The crossing is now in constant use, and has been found quite satisfactory, though on boggy ground. This was a most satisfactory piece of work for a field forge, and reflects great credit on the officers and men of the 109th Company of the Royal Engineers.

* * *

MR. CHARLES TRAVIS has been appointed to the position of Assistant Agent at Marylebone Goods station, Great Central Railway. Born in 1888, Mr. Travis entered railway service in 1904 as clerk in the accountant's office, and subsequently spent six years in that department before passing the 1910 higher grade examination. He then followed the comprehensive course of training instituted by Sir Sam Fay for the successful higher grade students, being located in the stores, rolling stock, marine, engineering, locomotive, goods, and traffic departments in that sequence. He has been appointed from the General Manager's department to his present position. Mr. Travis is one of the authors of "The Elements of Railway Operating Economics," " Passenger and Goods Station Management and Working," and " Practical Railway Working."

* * *

THE " Call of the Countryside " is well emphasised by the Underground Railways in a new selection of original posters. They include a series of 12 charming nature and flower studies by Mr. E. C. Tafani. Printed double-crown size, at the foot of each is a suitable inscription in connection with the subject of the poster. Another striking " Senefelder " poster is by the artist Hartrick, entitled " A Summer Evening," which, together with the companion bill, designed in the form of an invitation to participate in quietude, makes an exceptionally artistic setting, and goes far to enhance the reputation of the Underground. In connection with Southend-on-Sea there is also a new quad-royal bill by Mr. Charles Pears, which is quite in keeping with his usual admirable style.

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On Sunday, June 6th, the new Underground station in Elgin Avenue, known as Maida Vale, was opened for traffic, thus completing the extension of the Bakerloo Line from Paddington to Queen's Park. The new station is just off the Edgware Road, in a district which has hitherto been deficient in direct railway connection with the West End and City, a disadvantage which is now removed, seeing that the new station is provided with a 2½ minutes' service of trains. From Maida Vale to Piccadilly Circus the fare is 2d., while 3d. is charged to Waterloo. In addition to the frequent services to town and to Queen's Park, Bakerloo trains run every 15 minutes to Willesden Junction, where there is platform exchange with the North Western services to Pinner, Watford, and other residential districts traversed by the lines of the latter Company.

* * *

The North Staffordshire Railway now has eight of Mr. J. H. Adams' large 0–6–4 tank engines in service. These are fitted with superheaters and feed-water heaters, and are performing the heavy duties allocated to them in a satisfactory manner. These duties lie chiefly in hauling goods and mineral traffic, but during the War, they have taken a turn on extraordinary traffic, such as troop trains. During the last two years 28 new bogie carriages have been put into service. Some have 6 first-class compartments without lavatories for local traffic, others 6 first-class compartments with two lavatories in the centre, each lavatory serving three compartments. Others again are composite coaches having both first and third-class compartments with a corridor and lavatory for each class. The new trains are fitted with patent double shock-absorbing buffers which greatly minimise the shock by a sudden impact.

* * *

There will be no great holiday exodus from Swindon this year. Many of the Great Western Railway employés are busy on Government contracts, and it is necessary they should go on working at full pressure throughout the summer. In these circumstances the great annual "trip" promoted by the Great Western Railway Mechanics' Institution, which in the ordinary course would have taken place in July, has been abandoned, and notices have been issued by the Council to the following effect:—"The Council regret to announce that on account of the war it is not possible to make arrangements for running the 'trip' in July. The matter will, however, be reconsidered later with a view to ascertaining if the event can take place in September or early in October."

* * *

We regret to record the death in action of one of the most popular members of the staff at Euston, London and North Western Railway, Mr. Harold Bentley, of the Publicity Department, General Manager's Office, who enlisted as a private in the 13th County of London Regiment on the 3rd September, 1914, was killed in action on the 9th May last. Early in his military career he was promoted to the rank of sergeant, and it was quite evident that his devotion to duty and his capacity for management and control had established itself in his new sphere—as it was bound to do. At the time of his enlistment he was Hon. Secretary of the Operatic and Dramatic Society. He will be greatly missed in the Publicity Department, where he was always held in the highest esteem. He was well known at Euston and was respected by everybody with whom he came in contact, and his loss is the more to be regretted as he was practically the sole supporter of his widowed mother. He was 26 years of age.

* * *

A new goods station has been opened by the Great Western Railway at Cockett, in South Wales, about half-a-mile from the passenger station. All descriptions of merchandise and mineral traffic can be conveniently dealt with at the new station, and accommodation will be provided for handling live stock traffic.

* * *

The North British Locomotive Company have contracted for the supply of 100 main line passenger and goods locomotives for the French State Railways. The Company was approached to see whether it could help the French Government in this time of emergency, as some of the important locomotive works in France are in the hands of the enemy, while others, owing to the war, are very short-handed. The Company communicated with our own War Office, and, having obtained its consent to the work being included in the category of war supplies, a contract has been entered into between the parties on the basis of early delivery.

* * *

Great Western 4–4–0 engine No. 16 *Brunel*, one of the original series of 4–4–0 narrow gauge locomotives, has been re-numbered 4169, thus immediately following the 20 "Flowers." As originally built, *Brunel* had three sister engines, Nos. 7 *Armstrong*, 8 *Gooch* and 14 *Charles Saunders*. Although No. 16, *Brunel*, has been renumbered 4169, one of her sister engines, *Armstrong*, which by a coincidence was turned out of the Swindon shops after rebuilding a few days later, still bears her original number "7."

* * *

The newly created Government department for the production of munitions of war, of which Mr. Lloyd George is in charge, includes Mr. E. C. Geddes, Deputy General Manager, North Eastern Railway. Educated at Edinburgh Academy, Oxford Military College, and Merchiston Castle School, Edinburgh, Mr. Geddes was originally intended for the army, but after passing preliminary examinations he went to the United States, and commenced railway service about 1890 on the Baltimore and Ohio Railway in West Virginia. There he had general experience in operating work both at stations on the line and in marshalling yards. In 1895 he left America and went to India, and shortly

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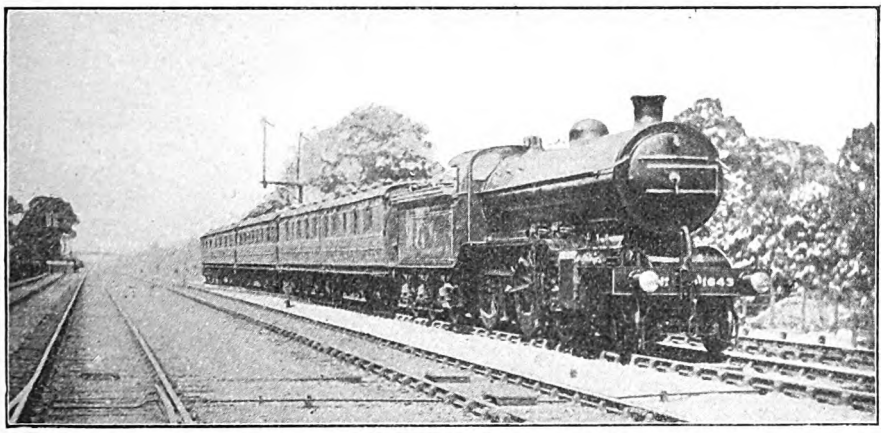
became Manager of the Powayan Steam Tramway—a 2 ft. 6 in. light railway, about 40 miles long, running northwards from Shahjehanpur. When the light railway was taken over by the Lucknow-Bareilly State Railway Mr. Geddes was appointed Assistant Traffic Manager to the Rohilkund and Kumaon Railway system, and a year later became Traffic Manager, which post he held until October, 1904, when he joined the North Eastern Railway as Claims Agent. In 1905 he was appointed Commercial Agent, and in 1906 became Deputy Chief Goods Manager. Six months later he succeeded to the post of Chief Goods Manager, and during 1911, Mr. Geddes became Deputy General Manager. In 1908 he was one of six railway officers appointed by the Board of Trade to form, along with certain traders, a sub-committee of a Board of Trade Railway Conference then being held. In the same year he was appointed by the Foreign Office as British Delegate to the Swedish Railway Rates Commission, to report to the Board of Trade on through rates between Great Britain and Sweden in connection with the situation brought about by the opening of the Tralleborg-Saonitz Ferry. Mr. Geddes is a Lieut.-Col. in the Engineer and Railway Staff Corps.

* * *

A NEW passenger line from Hessle Junction to Hessle Road level crossing, on the Selby and Hull line, North Eastern Railway, has been opened for traffic. The new line is a diversion from the former route, and has been rendered necessary by the extensive mineral yards now being constructed on what is known as the Priory. Some few years ago the original line was diverted round the Old Priory mineral yard to admit of various widenings and extensions in the yard. It was found needful, however, in order to accommodate the increasing coal traffic for the Hull Dock, to make further reconstructions at Priory, and to do this the passenger line from Hessle has been carried back to approximately the old alignment; but instead of proceeding on the level an embankment has been built about a mile and a quarter from Hessle Station, and descending to the surface again near Hessle Road level crossing. The embankment reaches a height of 20 ft. rather more than half-way in its length, where it is intersected by four lines from the mineral yards, giving access to the Dairycoates sidings and the docks on the Humber side. The new line is carried by a brace girder bridge on the skew, with a single span of 179 ft. on the skew and a square width of 98 ft. The work forms a part of an extensive scheme of sidings, with reception and empty mineral yards and sorting yards. These, when completed, will contain some 75 miles of sidings, and will furnish accommodation for about 11,000 mineral wagons. On the south side of the passenger line there is a considerable expansion of the engine sheds in progress, and it is also proposed to instal a mechanical coal-loading appliance for locomotives, on the conveyor-belt principle.



Photo] [*R. Hall.*

GREAT NORTHERN RAILWAY.

11.40 a.m. train from Hitchin to London.

2-6-0 locomotive No. 1643.

* * *

FOLLOWING the departmental reorganisation on the Great Eastern Railway, referred to in our May number, and which has involved the transference to the operating section of certain divisions of the locomotive department, a company of nearly 50 assembled recently for dinner at the Liverpool Street Hotel on the invitation of the Chief Mechanical Engineer, Mr. A. J. Hill. He had the support, amongst others, of Messrs. H. W. Thornton, William C. May, F. V. Russell, C. W. L. Glaze, H. Rudland, H. F. Hilton, A. P. Turner, A. Lansdell, H. W. C. Drury, C. M. Stedman, J. H. Bowles and J. Farnie. During the proceedings Mr. Turner, on

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behalf of the subscribers, presented to the Chairman a silver bowl and a pair of silver candlesticks, the former being inscribed: "To Mr. A. J. Hill, in pleasant recollection from his former assistants in the locomotive running department, Great Eastern Railway, April, 1915."

* * *

MR. J. M. EDDY, Mineral Traffic Manager, London and North Western Railway, has been appointed Assistant to the General Manager, Buenos Ayres Great Southern Railway. Mr. Eddy is the son of the late Mr. E. M. G. Eddy, who was for many years an officer of the London and North Western Railway, and who subsequently became the first Chief Commissioner of the New South Wales Government Railways. Mr. Eddy entered the service of the North Western in 1898, and was attached to the Goods Department, where he gained experience in the South Staffordshire, Northampton and London districts. In 1900 he was transferred to headquarters, where he was attached to the Outdoor Goods Manager's Department until 1903, when he was appointed Assistant to the Traffic Superintendent for the Lancaster Division. After two years at Lancaster Mr. Eddy was created Assistant Rolling Stock Superintendent, and, when Mr. Rowell resigned early in 1911, Mr. Eddy succeeded him as Rolling Stock Superintendent, a position he held up to the time of his appointment at the close of 1912 as Mineral Traffic Manager in succession to the late Mr. Mitchelhill.

* * *

A NEW line in the neighbourhood of Formby, Lancashire, is shortly to be considered by the Light Railway Commissioners. Powers for the construction of this line are being sought by the Lancashire and Yorkshire Railway Company. Commencing by a junction with the Liverpool, Crosby, and Southport line, almost immediately to the north of Hightown station, it will run parallel with the existing line as far as Altcar Rifle Range station, thence following the coast. After running close thereto for a distance of some 3 miles, it will take an easterly direction to a junction with the Liverpool and Southport line at a point about 1¼ miles south of Ainsdale station. This line will be, in effect, a loop line to the existing railway.

* * *

FROM Crewe a RAILWAY MAGAZINE correspondent writes:—"The five London and North Western Railway engines of the 4-4-0 ('Precursor') type to be converted to superheater during the half-year ended June 30th are now all at work, being Nos. 60 *Dragon*, 643 *Sirocco*, 659 *Dreadnought*, 1137 *Vesuvius*, and 1617 *Hydra*. Several more of the 'Alfred the Great' class of four-cylinder compounds are being converted into two-cylinder simple engines. The four-cylinder passenger engine No. 1361 *Prospero*, which was recently converted from a two-cylinder ('Experiment' class), is now in regular working. It usually can be seen working the 11.6 a.m. passenger train to Carlisle. Recent withdrawals from service include No. 2175 *Precedent*, the first of that well-known type of engine, introduced by Mr. Webb."

* * *

MR. W. R. S. SMART, of the Model Railway Club, read a paper at the June meeting of the Railway Club, his subject being "The aim of the Model Railwayist." The paper instanced the necessary factors in the setting up of a model railway "system," *i.e.*, the room at the disposal, the size of the railway and the cost. Mr. Smart described the comparative costs and merits of railways of different gauges, their limitations and capabilities. He also exhibited plans of various "systems," and a number of photographs and models.

* * *

THE HON. RUPERT E. BECKETT has been appointed a Director of the Great Northern Railway Company in the place of Mr. Reginald Wigram, deceased.

* * *

OWING to the heavy national demands upon the railway workshops, we understand that the London and North Western Railway, after several decades of universal Crewe construction, are giving out orders for forty engines, while the Great Northern have ordered twenty 2-6-0 locomotives from Messrs. Beyer, Peacock & Co., Ltd.

* * *

THE Wirral Railway have issued their usual "Holiday and Residential Guide." It is well illustrated, several views showing scenes on the line, and readers are recommended to write to Mr. J. H. Burns, Traffic Manager, New Brighton station, for a copy.

* * *

THE Great Northern Railway of Ireland again issue their annual guide and tourist and excursion arrangements, and as the Irish railways are not under Government control and guarantee, an interesting variety of special excursion, circular tour and other facilities is offered. Copies can be had on application to Amiens Street station, Dublin.

* * *

"THROUGH the Garden of Ireland," reappears this summer, and includes particulars of numerous holiday arrangements. Copies of this, as also of the excursion programme, can be had on application to Mr. A. G. Reid, General Manager, Dublin and South Eastern Railway, at Westland Row station, Dublin.

* * *

BY HIS MAJESTY'S command the Lord Lieutenant of Ireland, Grand Master of the Order of St. Patrick, has appointed the Earl of Bessborough, Chairman, London, Brighton and South Coast Railway, Knight of the Order and invested him with the Insignia of Knight Commander of the Order.

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THE Board of Trade have recently confirmed the Order made by the Light Railway Commissioners for the Clayton-le-Moors Light Railway (Extension of Time) Order, 1915, extending the periods limited by the Clayton-le-Moors Light Railway Order, 1912, for the compulsory purchase of lands and for the completion of the railway and works thereby authorised.

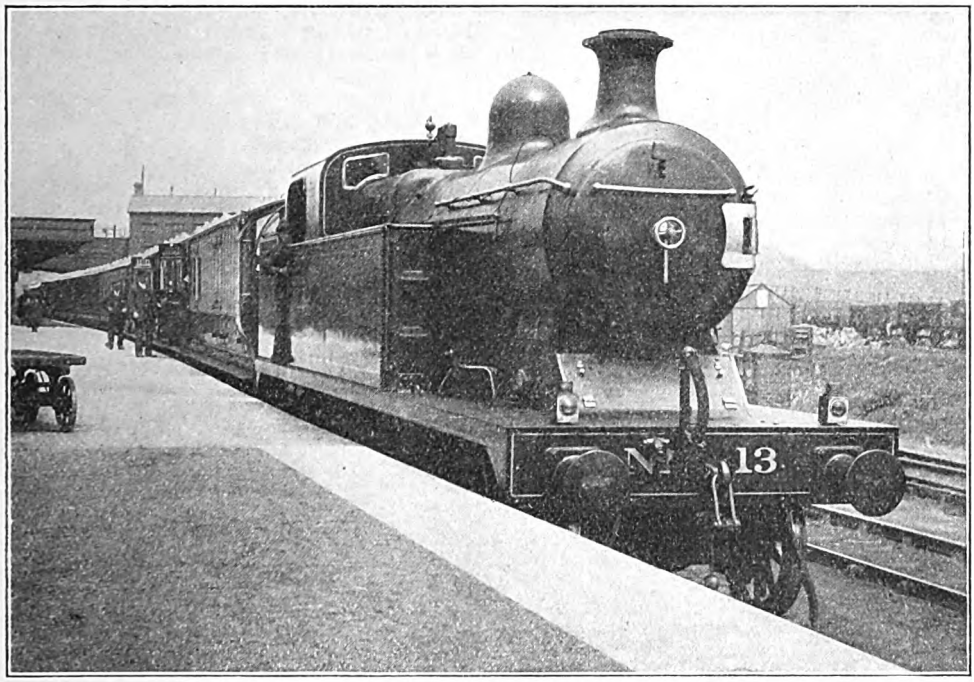
* * *

THE Right Hon. L. A. Waldron has been re-elected Chairman and Mr. Joseph Tatlow Deputy-Chairman of the Dublin and Kingstown Railway.

The General Passenger and Emigration Offices will, as formerly, be conducted from 21, Charing Cross, S.W.

* * *

A MOTOR trolley, of the type used for permanent way inspection purposes, adapted to haul an ambulance trailer, is now attached to the Union Forces engaged in German South-West Africa. The trolley is of the standard type for inspection work, equipped with a 6-h.p. V-type twin-cylinder engine, gearing giving two speeds, both forward and reverse. The trailer underframe, on which has been fitted the body and canopy, is of the same type as that of the motor trolley with the engine, etc., omitted. It carries two stretchers, the attendants being accommodated on the rear seat of the trolley. Beneath the floor of the ambulance, and attached to the chassis, is a cask containing water, while other necessary comforts and equipment for the wounded are also suitably stored in sundry positions.



Photo] [*J. Emery.*

NORTH STAFFORDSHIRE RAILWAY.

9.22 a.m. Manchester-Stafford train at Etruria.

N.S.R. superheater tank engine No. 13, L. & N.W.R. rolling stock.

LARGE contracts for the supply of war materials are, as is known, being carried out by various factories in the United States. The American Locomotive Company's order for shrapnel amounts to approximately $65,000,000. Of this total $32,500,000 has been equally divided between the New York Air Brake and the Westinghouse Air Brake Company.

* * *

THE Canadian Northern Railway have transferred their Leadenhall Street offices to new premises at 9, Bishopsgate, E.C., for the Freight, Passenger and Publicity Departments.

* * *

AN inspection car of somewhat unusual type has been introduced on the Grand Trunk Railway for special inspections by parties of officials. This car has the observation end

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completely glazed, with a central door with large window panel, and two side windows, all the windows being of nearly full depth. From the observation end the floor is tiered, with a rise of 4 in. in each tier, there being eight tiers extending to about the centre of the car. The seats here give an observation seating capacity of thirty-two. From the highest tier level, a flight of four steps leads down to the car level, and in the rear section of the car there is a table between two car seats, and along the walls nine arm-chairs.

In front of the observation-end windows a narrow table runs the width of the car, on which there are ten sets of keys, arranged in pairs, each pair to be manipulated by one observer. The several sets of keys are named respectively, line, surface, joints, tie spacing, drainage banks, ditches, ballast, station grounds, policing, fencing, buildings, spikes, side tracks. Under the several headings is divided all the work that comes under the care of the maintenance of way departments. Immediately over the keyboard, under the decking, there is a large 10-unit annunciator indicator correspondingly marked with the above lettering in larger type that can be seen from the rear of the cars. The annunciator units are electrically operated from the keyboard below.

Along the front row of seats before the keyboard desk five officials observe the line, and outline their judgments on the different conditions of the track on the annunciator above. Each official has charge of two keyboards, and at the end of each mile registers his judgment of that mile on the annunciator above. In the rear of the car, clerks placed at the desk note these observations, and at the end of each section, which is 5 miles long for single track and 4 miles for double, an average of the observation is struck. The summation of these observations for the division is a measure of its standing.

* * *

For the year ending March 31st, 1913, the report of the Chosen (Korea) Railway shows that the average working mileage for passenger traffic was 802·9 miles and in goods traffic 797·3 miles, showing increases of 93·9 miles in the former and 88·4 miles in the latter over the preceding year. The train mileage totalled 3,015,987 miles, the number of passengers carried, 4,399,022, and the tonnage of freight hauled, 1,105,362 tons, showing increases of 708,320 miles in train mileage, 1,969,335 in passengers, and 42,251 tons in freight hauled, compared with the corresponding figures of the preceding year. The aggregate passenger and freight mileages were 165,034,551 and 100,282,500 respectively, being an increase of 60,038,511 in the former and of 9,854,175 in the latter over the preceding year. Station hotels at Fusan and Shingishu are new developments. They occupy the second floors of the station buildings. Nine rooms for seventeen guests are provided at Fusan Station Hotel, and eight rooms for fifteen guests, at Shingishu. Billiard rooms, bars, reading rooms and roof garden are also provided at these hotels. Rooms and meals are charged separately, as is done in Europe. The Station Hotel at Fusan was opened on July 15th, and that at Shingishu on August 15th, 1912. Rolling stock and steamboats at the end of the year included 138 locomotives, 209 carriages, 1,445 wagons, and two steamboats. During the year five six-wheels-coupled, double-ender tank engines were received from Germany.

* * *

The Paris, Lyons and Mediterranean Railway announce that their motor-cars, which have been so much appreciated by the tourist, since their first appearance three or four years ago, will run daily this summer from July 1st to September 15th (when not otherwise stated), on the Route des Alpes, and the Dauphiné, Savoie, Jura, and Auvergne routes. Detailed time tables can be obtained on application to the London office at 179, Piccadilly.

* * *

It is stated that the Canadian Pacific Railway's luxurious observation cars in use on the Austrian State Railways, which were, of course, seized by the Austrian Government at the outbreak of the war, are now being used as travelling *ambulances de luxe* for wounded Austrian officers of high rank. The cars, ten in number, are said to have been specially fitted up with beds, operating tables, etc., and most of the Red Cross nurses employed in them are titled Austrian women.

* * *

The Darjeeling-Himalayan 2 ft. gauge mountain railway was opened in 1881, and is noted for its excessive curvature and steep grades of 1 in 29, and occasional sections at 1 in 25 and 1 in 23. Hitherto it has been worked mainly by small tank engines and by a 0–4–4–0 Garratt locomotive. To meet more arduous requirements, and with special view to the working of the "Limited Expresses" between Siliguri and Darjeeling, 51 miles, two 4–6–2 tender locomotives have been built by the North British Locomotive Co., Ltd. There are several 4–6–2 engines working on 3 ft. 6 in., metre, and 3 ft. gauge lines, but these are the first of the type on so narrow a gauge as 2 ft. The firebox is of Belpaire type, the frames being widened to receive it. An unusual feature is that the rear-coupled wheels are the drivers. The trailing wheels are mounted in a truck. The safety valves—of "pop" type—are placed on the steam dome. Valve motion of the Walschaert type is employed.

Leading dimensions are: Cylinders—diameter, 13½ in.; stroke, 16 in. Wheels—coupled, diameter, 2 ft. 6 in.; front bogie diameter, 1 ft. 6 in.; hind bogie diameter, 1 ft. 9 in. Wheel-base—rigid, 5 ft. 9 in.; total, 18 ft. 2½ in. Working pressure, 160 lbs. per sq. in.; heating surface, 835 sq. ft.; fire grate area, 16 sq. ft.; weight in working order, 28 tons 1 cwt.

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As a result of the disastrous accident on the New York Subway, the Public Service Commission has issued an order to the Interborough Rapid Transit Company directing it to remove wooden cars from operation on the subway lines and to replace them with cars of all-steel construction, of a type similar to cars now being used. It was further ordered that the Interborough begin the retirement of wooden cars on May 1st, and complete the replacement on or before December 1st, it being the opinion of Electrical Engineer Wilder, of the Commission, that the 478 steel cars required can be acquired within 10 months. The order was based on the ground that the operation of cars of wooden construction in the Subway was unsafe, improper, and inadequate. Mr. James L. Quackenbush, counsel for the Interborough, objected to the order unless the Interborough was allowed to put the wooden cars on the elevated lines, but the Commission took the ground that the order was in line with its duty as a Public Service Commission, and that the matter of transferring the wooden cars to the elevated railroad would have to come up at another hearing. Mr. Quackenbush intimated that the Interborough might apply for a new hearing.

* * *

THE Paris, Lyons and Mediterranean Railway opened for traffic on May 16th the new "Frasne-Vallorbe" line, the construction of which was commenced at the end of the year 1910. This line has a double track of about 24 kilometres (15 miles) in length, 22 of which are in French territory. It branches off from the Dijon-Pontarlier line at Frasne. It crosses one of the most picturesque districts of the French Jura, and rises between two green-clad mountains, which form an extension of the forest of La Joux, celebrated for its giant firs. The new line serves the two beautiful lakes of Remoray and Saint-Point, penetrating the "Mont-d'Or" through a tunnel of 6,670 yards in length, and joining again the Pontarlier-Lausanne line at Vallorbe. The opening of this line avoids the circuitous route *viâ* Pontarlier, thus shortening the journey by nearly 10 miles, and completing under most favourable conditions the International main line from Paris to Milan *viâ* the Simplon. The improvements carried out over this section, and on the track generally, have resulted in a gain of from 45 minutes to one hour on the duration of the journey between Paris and Lausanne. Curves are favourable for speed, and in winter the tunnels and pine forests through which the line passes are a protection against snow-storms.

* * *

AT the Panama-Pacific Exhibition the Baldwin Locomotive Works are showing six engines—one of the "Pacific" (4–6–2) type; one of the 2–10–2 type for heavy goods service; and four of the "Mikado" (2–8–2) type, two of the latter being designed for "logging" service. One of the 2–8–2 locomotives was built expressly for exhibition purposes, while the other was built for the McCloud River Railroad, and is shown in the exhibit of that line, for service on lines laid with rails weighing 56 lb. per yard, and having curves of 30 deg. and gradients as steep as 1 in 14½. The first is designed for rough service. The locomotive for the McCloud River Railroad is specially fitted for road service. The two other "Mikado" type locomotives are respectively for the Southern Pacific Company and the San Pedro Los Angeles and Salt Lake Railroad. They are very similar, and are both intended for passenger service on heavy gradients. The driving wheels are 63 in. in diameter. Both burn oil and use superheated steam. The 2–10–2 locomotive is for the Chicago Burlington and Quincy Railroad, and the "Pacific" for the Atchison Topeka and Santa Fé Railway. The former is designed for slow-speed goods service, and is one of thirty-one engines of this type which have been built for this line by the Baldwin Locomotive Works. The Atchison Topeka and Santa Fé engine is the heaviest of its type thus far built for this railway. The boiler is designed for a steam pressure of 225 lb. per sq. in., but in service the valves are set at 200 lb. The superheater is of the Schmidt type, with forty elements. It is an oil-burner. Steam distribution is controlled by 16 in. piston valves driven by Baker valve gear.

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Railway Literature.

RECORDS OF RAILWAY INTERESTS IN THE WAR. [*The Railway News.* Price 1s.] Part II. of this presumably serial publication has now been issued by our contemporary. It covers the period from January to April, 1915, and collects all material of railway interest necessary to supplement the first number. Contents include illustrated particulars of ambulance trains built here for service on the Continent; details of railway companies' help for soldiers and sailors, and of rest rooms and the like at various stations; together with a number of articles on various subjects of statistical and general interest at this time. Readers will be well advised to secure a copy, as also of No. 1, if not already obtained. The two parts can be supplied from the RAILWAY MAGAZINE office, post free 2s. 4d.

* * *

THE HISTORY AND ECONOMICS OF TRANSPORT. By Prof. Adam W. Kirkaldy, M.A., B.Litt. (Oxford), M.Com. (Birmingham), Professor of Finance in the University of Birmingham, and Mr. Alfred Dudley Evans, secretary of the Birmingham Exchange. [Sir Isaac Pitman and Sons, Ltd. Price 7s. 6d.] While the primary aim has been to produce a text-book for the student, the work will also be of unusual value to the general reader, and particularly to the business man whose daily affairs bring him into close contact with the problems of transport. The subjects are clearly explained, and controversial points are treated with fairness, the pros and cons being impartially stated. After sections dealing generally with methods of transport and their development, and the railway in the United Kingdom and abroad, special chapters are devoted to railway economics, canal economics, and shipping and ocean transport.

* * *

THE EARLY MOTIVE POWER OF THE BALTIMORE AND OHIO RAILWAY. By J. Snowden Bell. [Angus Sinclair Co., 114, Liberty Street, New York, U.S.A.] This book, price 2 dollars, fully illustrated and well bound in cloth, deals with early days in the locomotive history of what was, perhaps, the most interesting of the American railways. Original developments offer many equivalents to the first stages in railway history at home. The Baltimore and Ohio was not quite the first railway in the United States, but occupies very nearly the same position as our own Liverpool and Manchester Railway. It was the first railway of any considerable length, designed for the purpose of general passenger and freight traffic. The first locomotive built in the United States ran upon it, in 1830, only about ten months after the historic Rainhill contest. Construction of the Baltimore and Ohio Railroad commenced on July 4th, 1828, and the first section of 13 miles was opened on May 22nd, 1830, vehicles being hauled by mules. Soon after a car was operated by sails, and this development, witnessed by the then Russian Ambassador, who was presented with a model to be forwarded to the Russian Emperor, led to Mr. Ross Winans going to Russia to superintend the construction and operation of the original railways there. Peter Cooper's locomotive engine followed; and just as Stephenson's *Rocket* paved the way for steam traction on the Liverpool and Manchester Railway, so this little locomotive inaugurated the era of steam on the Baltimore and Ohio Railroad. Then in 1831 a competition was opened, on very much the same lines as our own Rainhill contest. Three engines were entered; only one, *The York*, led to substantial results. Mr. Bell tells us about these engines, and carries us through the long list of remarkable and more or less peculiar engines of those early days—the "Grasshoppers," the "Crabs," the "One-armed Billies," the Winans and Norris engines, and the numerous locomotives of ordinary and special types which followed them. The author completes his work by a brief review of modern motive power on this line.

* * *

THE LOCOMOTIVE PUBLISHING CO., LTD., of 3, Amen Corner, Paternoster Row, London, E.C., have added to their series of sectional explanatory charts of locomotives a new one of a Great Indian Peninsula Railway 4–6–0 superheater express engine, designed by Mr. S. J. Sarjant, Locomotive Superintendent, and built by the North British Locomotive Co., Ltd. The price of the chart is 1s., post free to any address.

* * *

MESSRS. PERCIVAL MARSHALL & CO. send copies of their latest addition to the Model Engineer series of booklets. Price 6d. net. No. 38 deals with "Micrometers, slide gauges and calipers: their construction and use." The authors are Alfred W. Marshall, M.I.Mech.E., and G. Gentry. Fully illustrated, and well-presented, this booklet, like its predecessors, may be commended. The same publishers also send a copy of "Every Boy's Book of Electricity," price 1d.

* * *

THE eleventh annual publication issued by Mr. Slason Thompson's Bureau of Railway News and Statistics, Chicago, reviews the railway statistics of the United States for the year ending June 30th, 1914, in comparison with the official reports for 1913, and recent statistics of foreign railways.

* * *

MESSRS. JOHN BARTHOLOMEW & CO., of the Geographical Institute, Edinburgh, have issued a new war map of Europe and the Mediterranean, price 1s. net.

* * *

MESSRS. A. P. LUNDBERG & SONS, of 477-489, Liverpool Road, Islington, send a copy of their booklet on electric light switching, now in a third and enlarged edition.

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Photo] [*F. E. Mackay*

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.

"The Southern Belle" leaving Victoria Station, London.
4-4-2 superheater locomotive, No. 422.

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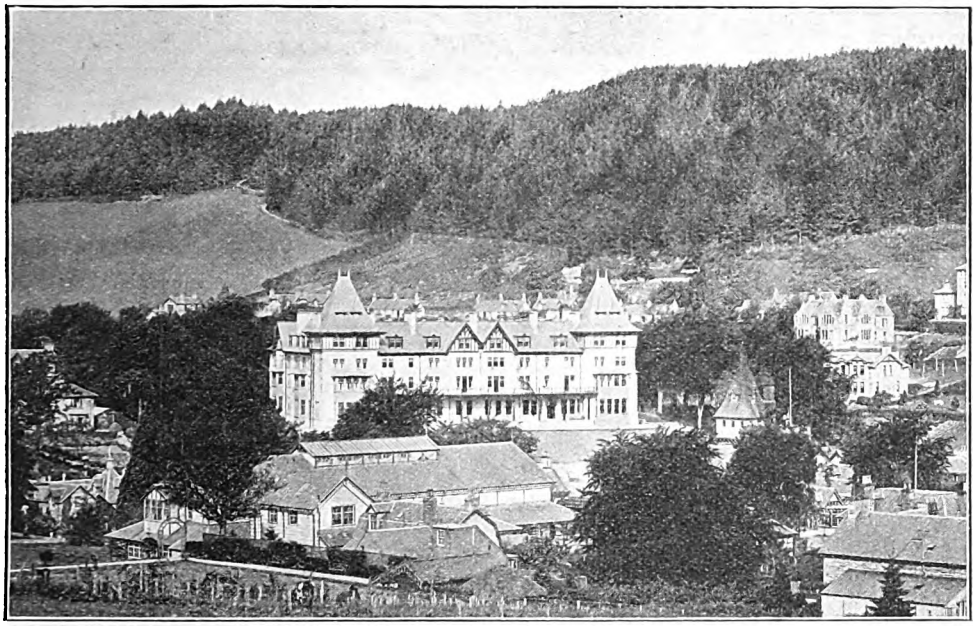

THE "HIGHLAND" HOTEL: STRATHPEFFER SPA.

The Jubilee of the Highland Railway.

By J. F. GAIRNS.

ON June 29th the Highland Railway Company completed fifty years' existence under that title, various lines already constructed being amalgamated by Parliamentary authority as from June 29th, 1865. It is thought, therefore, that an article dealing with this interesting railway will be in place, though as it has already received considerable attention, historically and otherwise, in the pages of the RAILWAY MAGAZINE, it is unnecessary to go so far into detail as would be appropriate were the subject being dealt with for the first time. For instance, as long ago as January, 1899, an "Illustrated Interview" with Mr. T. A. Wilson, late General Manager, was published, while Mr. P. Drummond, now Locomotive Superintendent, Glasgow and South Western Railway, received similar attention in February, 1902, when he had charge of the locomotives and rolling stock of the Highland Railway. Similarly Inverness station was dealt with as a "Notable Railway Station" in January, 1912; and at various dates a number of other articles dealing with phases of Highland Railway activity have been published in the RAILWAY MAGAZINE. It will consequently be sufficient to outline briefly the history and development of the Highland Railway system, further space being devoted to a consideration of the more notable features of its traffic, material and methods, and to its present position of one of the "great" railways of Great Britain, notwithstanding that it is the most remote from London.

At the date of formation the Highland Railway included five sections:

(1) Inverness and Nairn, 15½ miles, with a half-mile branch to Inverness Harbour; authorised by Act of July 24th, 1854; opened for passenger traffic November 5th, 1855, and for goods traffic December 3rd, 1855.

(2) Inverness and Aberdeen Junction Railway, from Nairn to Keith, 39¾ miles; authorised July 21st, 1856; opened from Nairn to Dalvey, 8 miles, December 22nd, 1857, to Elgin, March 25th, 1858, and to Keith, August 18th, 1858. This railway was authorised to take over the working of the Inverness and Nairn line, and the two sections were worked as one from the first, while on May 17th, 1861, they were

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amalgamated, retaining the title of the Inverness and Aberdeen Junction Railway, as by connecting with the Great North of Scotland Railway through connection was afforded between Inverness and Aberdeen, and *viâ* the "Granite City" with the Scottish North Eastern Railway and thence with Edinburgh, Glasgow and the south.

(3) The Inverness and Ross-shire Railway; authorised July 3rd, 1860; opened to Dingwall, 18½ miles, June 11th, 1862, to Invergordon, 31¼ miles, March 23rd, 1863; extended to Meikle Ferry, June 1st, 1864, and to Bonar Bridge, October 1st, 1864; worked by the Inverness and Aberdeen Junction Railway.

(4) Perth and Dunkeld Railway, 8½ miles; from Stanley Junction to Birnam (near Dunkeld); authorised July 10th, 1854; opened April 7th, 1856, and worked at first by the Scottish North Eastern Railway, now Caledonian.

(5) Inverness and Perth Junction Railway, 103¾ miles; authorised July 22nd, 1861; opened from Dunkeld to Pitlochry, June 1st, 1863, from Forres to Aviemore, August 3rd, 1863, and from Aviemore to Pitlochry, September 9th, 1863.

When completed the Inverness and Perth Junction Railway took over the working of the Perth and Dunkeld Railway, while from the first it operated in conjunction with the Inverness and Aberdeen Junction Railway, so that the combined system, known as the Inverness and Perth and Inverness and Aberdeen Junction Railways already provided the basis for combination as the Highland Railway, amalgamation dating as from February 1st, 1865, and the new title being authorised as from June 29th, 1865.

This system included also the branch from Alves Junction to Burghead, 5½ miles, opened December 23rd, 1862, while to the south the branch from Ballinluig to Aberfeldy was authorised before amalgamation and opened almost immediately after, on July 3rd, 1865. At this time therefore the Highland Railway already possessed 239½ miles of line, so that it was even then a system of considerable importance, especially in view of the fact that, including running powers over what is now the Caledonian Railway from Perth to Stanley Junction it provided a continuous line of railway joined on at Perth to almost the whole of the northern trunk line routes of Great Britain. In fact, even at that now remote date one could travel from the south for a continuous distance of 143¾ miles from Perth to Inverness, with a further 57½ miles northwards to Bonar Bridge, while a second connection with the railway system of Scotland was afforded *viâ* Aberdeen, that city being itself directly connected with Aberdeen.

Moreover, steps were already being taken for extensions still further to the north, though at first they were made as independent concerns. From Bonar Bridge to Golspie, 26½ miles, opened April 13th, 1868, constituted the Sutherland Railway. Then the Duke of Sutherland built the section from Golspie to Helmsdale, 17¼ miles, opened June 19th, 1871. Finally the Sutherland and Caithness Railway covered the 60 miles from Helmsdale to Wick, with a branch from Georgemas to Thurso, 6¾ miles, opened July 28th, 1874. These three lines were worked by the Highland Railway, and on September 1st, 1884, were amalgamated therewith. In 1870 the Dingwall and Skye Railway from Dingwall to Strome Ferry (53 miles) was opened, this also being included in the amalgamation of 1884.

Subsequent Extensions and Additions.

Remaining developments are of later date. So far the only branch lines dealt with have been the Inverness Harbour, Burghead and Aberfeldy branches, with the Skye line and the Thurso branch on the northern section. South or east of Inverness there are now, however, the Portessie-Keith line (13¾ miles, opened August, 1884); the extension of the Burghead section to Hopeman, a further 2 miles, opened October, 1893; the Orbliston Junction-Fochabers Town section, 3 miles, opened October, 1893; the Gollanfield Junction-Fort George line, 1¾ miles, opened July, 1899; and last, but by no means least, seeing that it has modified the whole of the traffic arrangements of the Highland Railway, the direct line from Aviemore to Inverness, 34 miles, opened November 1st, 1898.

North of Inverness there is first the Black Isle branch, from Muir of Ord to Fortrose, 13½ miles, opened February, 1894; the Strathpeffer branch, from the Skye line at Fodderty Junction, 1½ miles, opened May, 1885; the extension of the Skye line from Strome Ferry to Kyle of Lochalsh, 10½ very expensive miles, opened November, 1897; the Dornoch Light Railway, between Dornoch and The Mound, 7¾ miles, opened June, 1902; and the Wick and Lybster Light Railway, 13½ miles, opened July,

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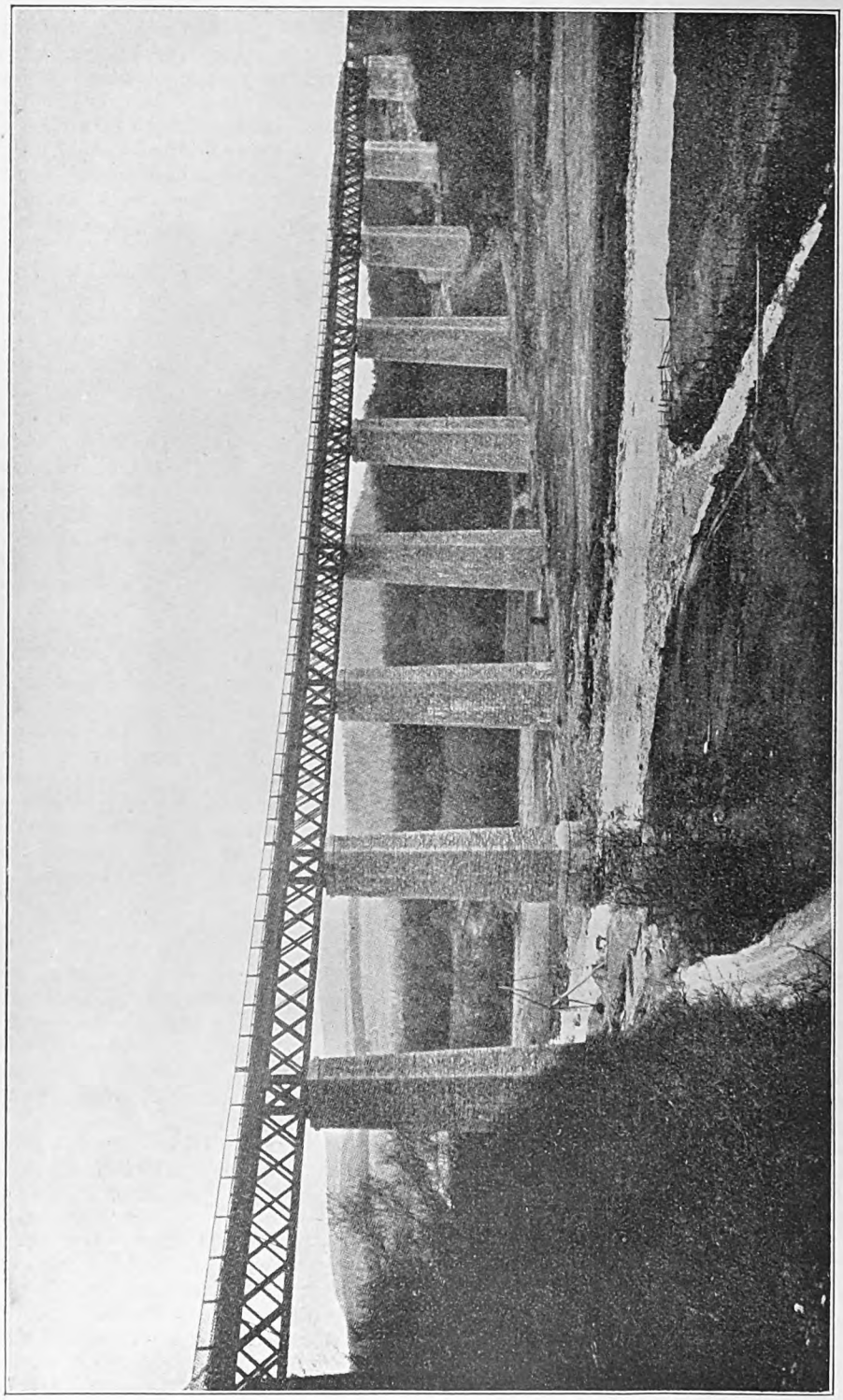

FINDHORN VIADUCT, HIGHLAND RAILWAY.

Built by Andrew Handyside & Co., Ltd., Derby. There are nine spans of 132 ft. each.

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1903. The last two are still independent concerns, but are worked by the Highland Company.

The net result is that whereas in 1865, when first constituted under its present title the Highland Railway covered a track mileage of 239½ miles, one can now make a consecutive journey involving the main line only of 279¼ miles, or *viâ* the old route from Aviemore to Inverness of 305 miles, while including branches and secondary lines there is now a total track mileage of no less than 507 miles 72 chains; a figure which places the Highland third among Scottish railways in respect of mileage of lines, and is exceeded only by the ten longest English and Welsh railways and by three Irish lines.

A "Unique" Express-Traffic Railway

Some years ago the Highland was appositely described as a "unique" line, in that it was virtually all single track. This is not quite so correct now as it was, seeing that during recent years considerable mileages have been doubled. Thus, there are now two lines of rail right through from Blair Atholl to Dalwhinnie, a distance of 23¼ miles, covering the whole of the formidable ascent of the Grampians on both sides, and thus overcoming one of the traffic difficulties involved by that terrible climb of 18 miles of unbroken up grade at 1 in 70 and 1 in 80 for down trains. South of Inverness the 11 miles from Inverness to Daviot on the direct line has been double track from the time this section was opened in 1898. North of Inverness the line has been doubled virtually from Inverness to Clunes, 7¼ miles, and two lines of metals have been in use for many years between Inverness and Dalcross, 6¾ miles. These are, however, the only sections which are double track in the ordinary sense. For nearly two miles north of Boat of Garten there are two lines side by side, but these are both operated as single lines, one being reserved for Great North of Scotland Railway trains for their approach to Boat of Garten station. Otherwise the remainder of the 77¼ miles recorded as second track are made up by station lines and loops, as also are the 4 miles 13 chains of third track, the 1 mile 1 chain of fourth track, and the 41 chains of fifth or sixth track. Virtually all this multi-track mileage is found at Inverness and terminal and chief junction stations, and the "unique" character of the Highland Railway is shown by the fact that whereas it has 505 miles 72 chains of first track, the total track mileage of running line is only 588 miles 71 chains; while sidings add a further 75 miles 26 chains of line.

But the "unique"-ness of the Highland Railway is evidenced not only by the very large percentage of single-track mileage, but is perhaps even more strongly indicated by the fact that over it are operated real express services with really heavy loads. It is true that one does not find 50 mile an hour averages; but that would be unreasonable seeing that long grades of 1 in 70 and 80 and not much easier are frequent, with sections at 1 in 60 and on the branches of 1 in 50 or thereabouts. But its schedules involve long non-stop runs of 35¼ miles between Perth and Blair Atholl—all single track, except the 7¼ miles over Caledonian metals—booked in 52 and 55 min. in the harder direction, and in 51 min. (usually including a stop at Perth ticket platform) in the easier direction; of 61 min. for the mountain section of 36¼ miles from Blair Atholl to Kingussie (54 min. in the somewhat easier south-bound direction); of 114 min. for the 68¼ mile run from Perth to Newtonmore by the usual summer 11.50 a.m. from Perth, though this has always in the writer's experience included a stop for water and assistance at Blair Atholl, though not scheduled to call at that station; the new non-stop run of 71½ miles from Perth to Kingussie in 111 min. in the case of the new "Winter Season" express put on last November; of 54 min. from Aviemore to Inverness (34¾ miles) by the summer 3.50 p.m. from Perth; the 44 mile run from Inverness to Tain by the down "Further North" express in 64 min., and of 45¾ miles in 73 min. from Helmsdale to Georgemas by the same train. These, and others not much slower, and some equally creditable for shorter distances, bespeak the Highland as a real "express" line, when account is taken of the grades involved.

Unfortunately the present summer includes only a few of these as there will be no "exodus to the North" as occurs in normal summer and autumn months. Yet, although this year the summer schedules are substantially those in force during the winter, modified a little to meet the reduced demands anticipated "owing to the war," there is still much very creditable work to be done. Under normal conditions, however, the actual demands are frequently much greater than the time-table indicates. It

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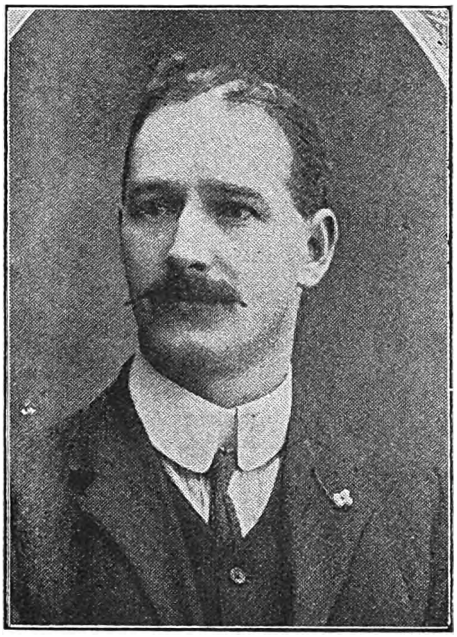
is by no means unusual for principal trains to be duplicated or even triplicated, and yet, as the present writer pointed out in the RAILWAY MAGAZINE for January, 1912, when describing the pressure at Inverness station, some of these sections, during the height of the season, may easily reach 375 tons in weight; and on the "Eve of St. Grouse" train after train may have to be dealt with, each of this heavy description, though not always on the fastest schedules seeing that the "shooting traffic" includes so many varied destinations that quite a number of stations may have to be served.

It follows that in view of the heavy loads and the exceptional grades there must be a considerable use of assisting engines. For this purpose Mr. Drummond introduced his 0-6-4 tank engines, and they are provided for working from Blair Atholl to Dalnaspidal, near the County March summit, the highest point (1,484 ft. above sea-level) reached by any main line in the United Kingdom; from Inverness to Slochd Crossing; from Kingussie to Dalnaspidal; from Aviemore to Slochd Crossing; from Forres to Dava or to Alves; and from Helmsdale to Altnabreac. Speaking generally, however, Mr. Drummond's "Castle" (4-6-0) and large "Ben" (4-4-0) locomotives can take up to about 200 tons unaided, even

MR. T. MCEWEN.
Traffic Manager.



MR. G. T. CORNET.
Secretary and Registrar.

on the fastest schedules, and Mr. Smith's forthcoming 4-6-0 locomotives may be expected to do even better with their much larger dimensions, superheaters and feed-water heating apparatus, while it would be unreasonable to expect 375 ton loads to be worked unaided over such grades. With the exceptional trains it is, in fact, by no means uncommon for them to be double headed right from Perth to Dalnaspidal; but in the ordinary way assistance is only taken when loads exceed about 250 tons or about 200 tons on the hardest sections. Otherwise the secret of the maintenance of relatively high average speeds is the provision of apparatus for exchanging tablets on single line sections without slackening—the writer has been on the footplate when this has been done at 60 miles per hour—of the alignment of passing loops so that, as far as practicable, the high speed direction has a straight run through, and of good unaided engine work on the moderately hard sections and with medium loads even on the very difficult sections.

SCENIC CHARACTERISTICS OF THE LINE.

So much for the general features of the line from the train-working aspect; and a few remarks may now be made from the

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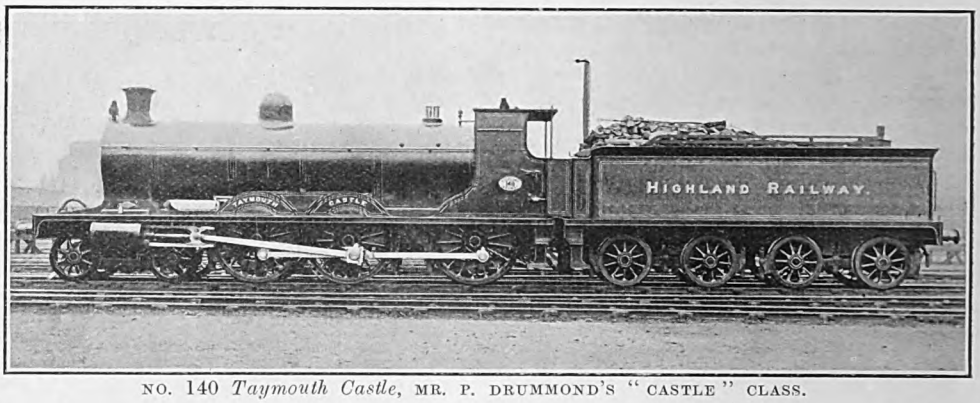
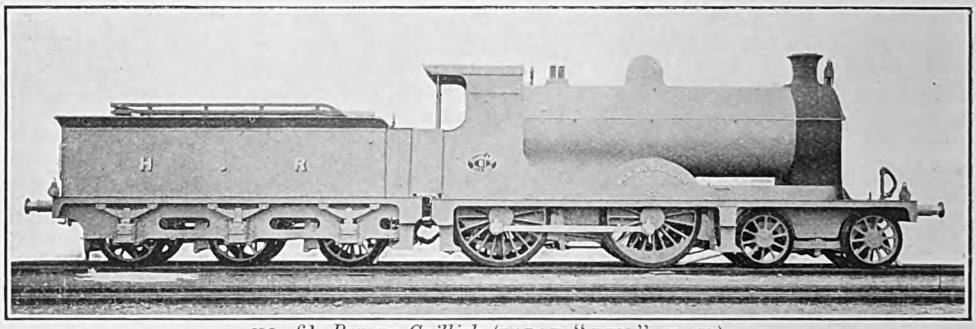
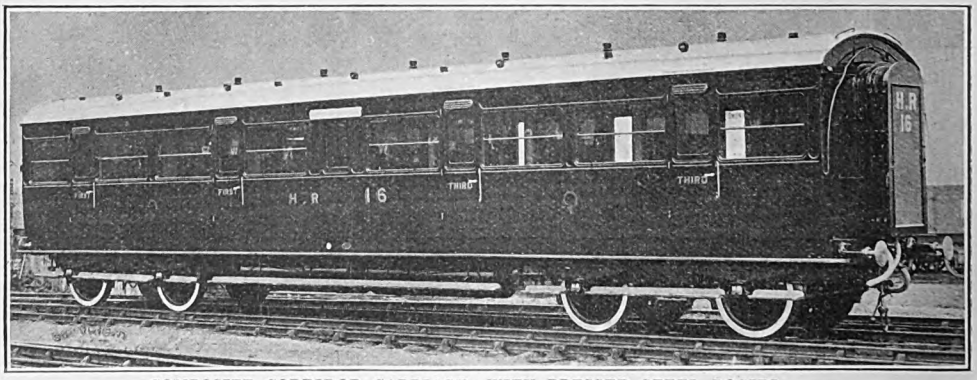


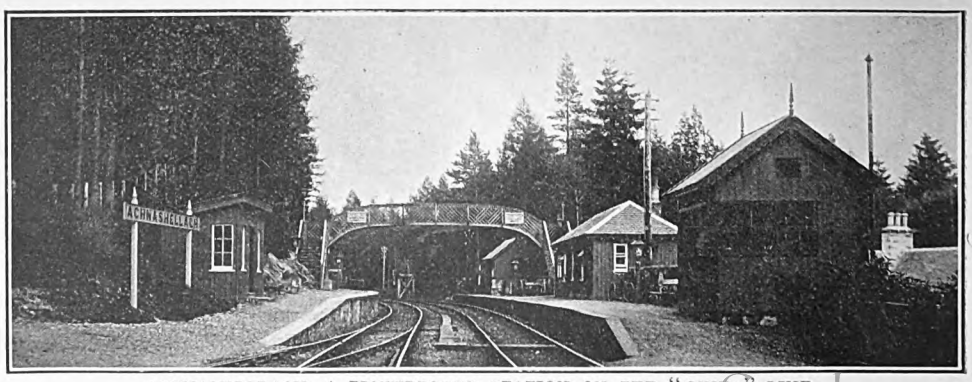
NO. 140 *Taymouth Castle*, MR. P. DRUMMOND'S "CASTLE" CLASS.



NO. 61 *Ben-na-Caillich* (LARGE "BEN" CLASS).



COMPOSITE CORRIDOR CARRIAGE, WITH PRESSED STEEL BOGIES.
Built by Hurst, Nelson & Co., Ltd.



ACHNASHELLACH, A PICTURESQUE STATION ON THE "SKYE" LINE.

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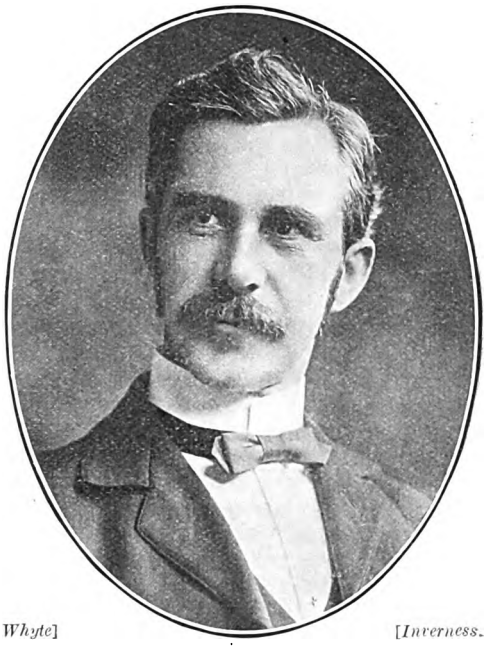
point of view of the ordinary traveller. As most people make their first acquaintance with the Highland Railway from the south a commencement may be made at Perth.

Leaving the General station the Highland goods depôt and engine sheds are passed as Caledonian metals are used to Stanley Junction, a peculiarly designed station seeing that down trains diverge at the end of the down platform to the Highland single track, whereas Highland up trains use the outer face of this same platform—thus being temporarily "wrong-sided"—and then cross the route of their own down trains to the Caledonian up line. This arrangement enables an up Highland train to clear the single line and yet wait if necessary before passing on to the Caledonian lines.

Immediately the Highland line begins to traverse a characteristic Scottish fir forest, and through Murthly, Dunkeld, Dalguise Guay, and Ballinluig to Pitlochry beautiful views are had of the River Tay, and of the tree-clad slopes on either side, with distant views of the mountains as they are approached. Then in the neighbourhood of Killiecrankie is *the* "scenic" point of the line, general views of the far-famed pass being had through the trees, and after passing over a fine viaduct from which a magnificent view of the pass is had, the train enters a short tunnel—one of the only three on the Highland Railway. So far the journey has been one of scenic interest, and through country that appeals strongly to the tourist, many of the stations being acknowledged centres for visiting places of historic importance.



Whyte] [*Inverness.*

MR. ALEX. MACDONALD.
Accountant.

Thomson [*Inverness.*

MR. F. G. SMITH.
Locomotive, Carriage and Wagon Superintendent.

After leaving Blair Atholl, however, the character of the country changes entirely. Instead of picturesque rivers, tree-clad slopes and distant hills, one enters a country of bleak barren mountains, rising one behind another, with others continually coming into view as the train proceeds, a picturesque mountain loch becoming visible here and there. In the writer's opinion this section from Blair Atholl to Newtonmore, and the corresponding stretch north of Aviemore through the Monadhliadh Mountains—the latter even more so—is the most attractive portion of the whole route. The bare mountain eminences, with their slopes gorse-clad in early summer and tinged by purple heather in autumn, a lonely loch, or an occasional water-fall lending variety, constitute the most interesting stages of the journey. Houses are few, and except for a

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shooting lodge or a crofter's or keeper's cottage here and there, hardly a sign of habitation is visible. Even the stations are separated by long distances, as for instance the 11¼ miles from Struan to Dalnaspidal, 7½ miles thence to Dalwhinnie, and the 10¼ miles onwards to Newtonmore. Yet with these long runs between stations, as the engine is toiling heavily up the seemingly endless grades of 1 in 70 and 80, the traveller is never tired of observing the ever changing vistas of mountain and loch opened for his inspection. But the snow fences which border the line indicate that in winter the task of maintaining railway communication is one of special difficulty, and one sometimes wonders that the early engineers had courage to attempt the construction of this line at all, bearing in mind too what the difficulties of transport of materials and of accommodation for the workers must have been when the work was undertaken away back in the early 'sixties.

Through Newtonmore, Kingussie (one of the chief refreshment stations, and the breakfast, luncheon and tea baskets here provided may be commended from personal experience), and Kincraig to Aviemore the scenery is not so remarkable, but at the latter station, itself a busy junction and a good centre for tourists, there are already

Thomson] [*Inverness*

MR. A. NEWLANDS, M.INST.C.E.

Engineer-in-Chief.

indications of what the Monadhliadh Mountains have to offer in the way of mountain scenery. *Viâ* the direct line to Inverness another long toil here commences and, passing Carr Bridge, a rising and already favourite resort, continues to the summit at Slochd Crossing, in the midst of wild mountain scenery which equals, and in the writer's opinion surpasses, that of the passage of the Grampians further south. Then follows a long descent to Inverness—a terribly hard section for up trains with its 10 miles of 1 in 60 from Inverness and only slightly easier grades to the summit—including the passage of the two great viaducts over the Findhorn and Nairn Rivers respectively.

The old route from Aviemore to Inverness *viâ* Forres avoids the chief difficulties of the direct passage through the mountains, and its scenery is not characterised by the bare bleakness of the Carr Bridge route. But it is equally picturesque, though in a different way, as the line passes, now in cutting, now on high embankment, curving its way through beautiful country or traversing avenues cut through the fir forests. Boat of Garten is an exchange station with the Great North of Scotland Railway. Grantown-on-Spey is in considerable residential

Mac Mahon] [*Inverness.*

MR. J. SUTHERLAND.

Factor and Commissioner.

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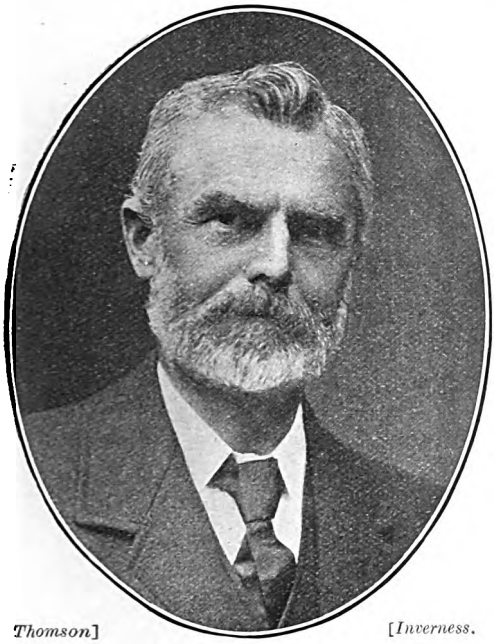

Thomson] [*Inverness.*

MR. D. BUTTER.
Cashier.

favour and is a splendid tourist centre, while at Forres one finds an important town with much of interest in its own district, and convenient for visiting the surrounding country.

From Forres the eastern lines to Keith and Elgin are used by direct trains between Inverness and Aberdeen, some being of a good semi-fast character and almost warranting description as expresses. These and some of the branches traverse characteristic Highland scenery, but without the special mountain interest of the main line. The same applies to the Forres-Inverness line, except that approaching the latter town splendid views of the Moray Firth are had, excelled however, by those obtainable from the direct Aviemore line as it approaches Inverness at a higher level. Nairn itself is sometimes described as the "Brighton of the North." To the southerner this appears somewhat of a misnomer, and hardly creditable to this northern centre; but Nairn is a beautiful little town, in great favour for residential purposes, and famed as a golfing resort, and for fishing and touring convenience.

Inverness and the "Far North" Lines.

Inverness, the "Capital of the Highlands," is a fair sized town, the headquarters of the Highland Railway Company with the railway works adjacent, and the business centre of the whole of this part of Scotland. It has several fine churches and other buildings, and is a pleasant city which may with advantage be selected for holiday residence. A few manufactures are carried on here, and the fishing business is, in normal times, considerable. The northern end of the Caledonian Canal is located here, and many visitors reach Inverness by this route. Northwards from Inverness the railway is continued through pretty country to Dingwall, crossing the Caledonian Canal by a swing bridge at Clachnaharry. At Dingwall the Skye line diverges, the branch to Strathpeffer leaving this at Fodderty Junction.

Strathpeffer is the most northerly Spa in the United Kingdom, and owing to its sheltered location is in great favour as a health resort. It is an exceptionally pretty place, and is a splendid centre for the tourist; and the realisation of which fact has justified the erection by the Railway Company of the Highland Hotel, a well-equipped and well-managed hostelry overlooking the town and from which the beauties of the whole of the valley appear to be spread out for inspection.

Whyte] [*Inverness.*

MR. C. KENNEDY.
Stores Superintendent.

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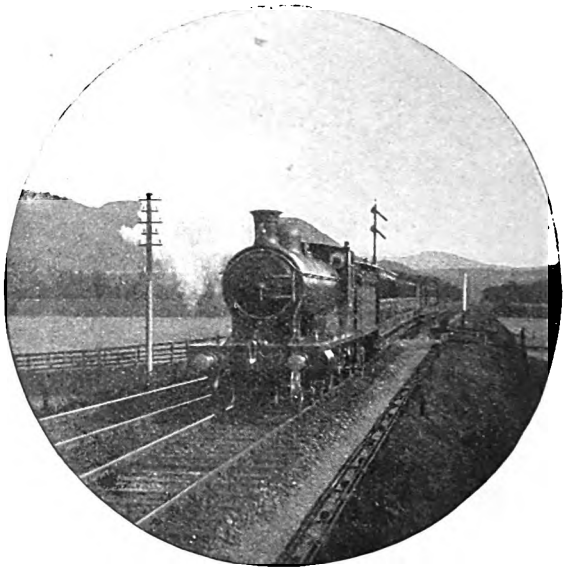
The Skye line is, perhaps, even more striking scenically than the southern main line. As it leaves the Strathpeffer branch it commences to wind round the base of the Raven's Rock, with incidentally a grade of 1 in 50 for four miles, and continues, now through fir forest or characteristic Highland scenery, now in the midst of mist-crowned and heather-clad mountains, or along the shores of a mountain loch. As the original terminus at Strome Ferry is reached it begins to run along the shores of Loch Carron, and the extension to the present terminus surpasses in scenic interest all that has gone before. This section proved exceptionally expensive to construct. It seems to consist mainly of rock cutting as the line curves in and out, following the shores of the Loch and giving magnificent views of the mountains across the water, until at the terminus one finds the station yard located on a space formed virtually by blasting out the solid rock, with the station itself on a quay built out so as to serve also the steamers which ply to the Hebridean Islands, the local fishing boats (responsible for a considerable industry) and the motor and ferry boats which maintain communication with the large island of Skye little more than half-a-mile across. Here the Highland Railway Company has erected an hotel, smaller than those at Inverness and Strathpeffer Spa, but well-appointed. It is located almost at the water side, and from the grounds in front one has a beautiful view of the heights of Skye and of the waters of the Kyle.



Photo] [*Tom M. L. Neish.*

3.50 P.M. PERTH-INVERNESS EXPRESS RUNNING THROUGH DALGUISE.

4-6-0 locomotive No. 147 *Beaufort Castle.*

From Dingwall to Wick and Thurso the main line is somewhat varied. In places it passes through characteristic Highland scenery, in other places it traverses wild mountain country, and towards the north one enters a bleak, treeless, moorland country, suggestive of many of the Scandinavian districts of the far north. Between Golspie and Brora is the Duke of Sutherland's private station for Dunrobin Castle, a fine view of which is had from the train. From The Mound station the Dornoch Light Railway diverges, and this serves this favourite golfing and tourist centre, where also the Highland Railway has provided a good modern hotel. Thurso is the most northerly station in the United Kingdom, but Wick is the more important as an industrial, boat-building and fishing centre. The Wick and Lybster Light Railway serves an agricultural district.

Photo] [*W. J. Norton.*

DUNKELD AND BIRNAM STATION.

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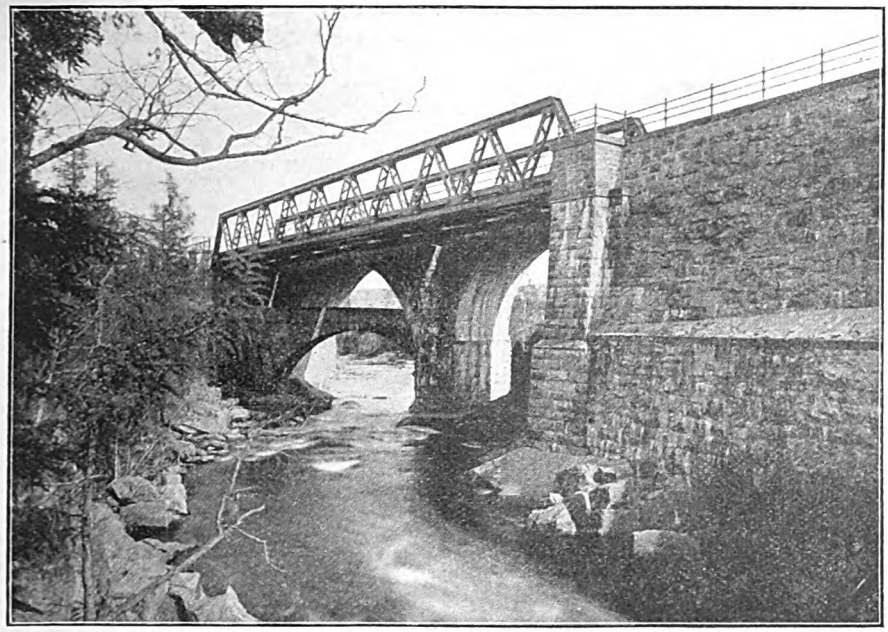
ENGINEERING FEATURES.

Remarks already made indicate that the construction and main-tenance of many of the Highland lines has been, and is no easy task. In fact, many of the works have entailed the construction of deep rock cuttings, high embankments, and remarkable viaducts, with snow fences and other protective arrangements to meet the conditions which have to be faced in winter, and rank among the most notable railway engineering undertakings in the United Kingdom.

The direct line between Aviemore and Inverness realises a gain of 34 miles in distance, but at the expense of costly and difficult engineering works. North of Carr Bridge, the line passes through wild, uninhabited country, and from this point onward, the construction of the railway involved high embankments preceding deep cuttings, and viaducts of great length crossing gorges and valleys at considerable heights. The first viaduct of importance is at the Pass of Slochdmhuic. The viaduct by which the gorge is passed is 400 ft. long, and stands 110 ft. above the bed of the small stream in the centre of the gully. Emerging from the gloom of the pass, the train reaches an open, trackless expanse of furze and heather. Between two enormous cuttings, into which the train disappears, the summit level of this portion of the line —1,323 ft.—is reached. The excavation of the second cutting, which for some distance has a depth of 51 ft., involved the removal of the enormous quantity of 350,000 cubic yards of material.

Descending into the valley of Strathdearn, the river Findhorn is crossed near Tomatin by one of the largest viaducts on the line, its length being 445 yards, with a maximum height of 140 ft. The superstructure is of steel, resting on granite piers, and the bridge is formed on a curve with radius of half a mile. Before reaching Culloden Moor station a fine view is obtained of the great viaduct across the valley of the Nairn. Constructed entirely of old red sandstone, it is one of the longest, highest, and most graceful of the kind in Britain. The viaduct is 600 yds. long, and consists of 28 arches of 50 ft. span, and one across the river bed of 100 ft. span ; greatest height 130 ft. From Culloden Moor the line falls with a steep gradient to Inverness.



STRUAN VIADUCT, PERTH-INVERNESS MAIN LINE.

The extension of the Skye line from Strome Ferry is probably the most remarkable section of all. In many places the line traverses cuttings blasted from the solid rock and twists about in marvellous fashion to find a convenient route. This section is

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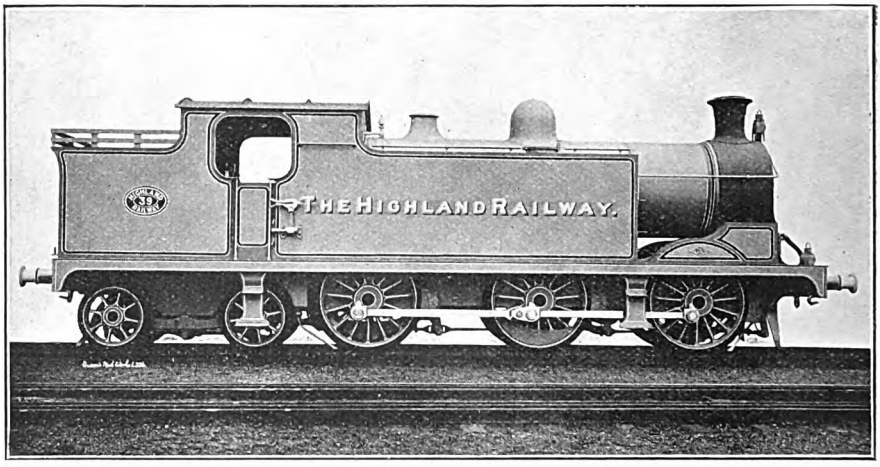
claimed to be the most expensive stretch of railway in the North, and cost about £250,000, of which £45,000 was defrayed by the Government of the day.

Other important bridges are found on the eastern lines, including the Spey Bridge at Orton, a fine lattice girder structure of 230 ft. span. The swing bridge at Clachnaharry, and the bridges and viaducts crossing the Rivers Tay, Trummel, Tilt, Ness, Beauly and Conon are by no means insignificant. Although essentially a mountain line the Highland Railway has only three tunnels, one between Murthly and Dunkeld, 310 yds. long; one between Dunkeld and Dalguise, 360 yds. long; and the other in the Pass of Killicrankie, already mentioned, 128 yds. long. Inverness is the only really large station, with seven platforms; but there are interesting structures at Aviemore, Grantown, Kingussie, Forres, Elgin, Nairn, Dingwall, Strathpeffer Spa, Kyle of Lochalsh, Thurso and Wick. In the category of engineering works may also be mentioned the fine hotels owned and operated by the Company at Inverness (adjoining the station) Strathpeffer Spa, Dornoch, and Kyle of Lochalsh, in addition to a share in the Station Hotel at Perth. The largest signal cabin is at Inverness (Welsh's Bridge Cabin—105 levers).

Locomotives and Rolling Stock.

In early days the Highland Railway possessed a number of interesting locomotives, not the least important being those designed by the late Mr. William Stroudley, some including characteristics which are usually associated with his later work on the London, Brighton and South Coast Railway. It was, however, the late Mr. David Jones who paved the way for the more modern era. His 4–6–0 goods engines were, in fact, the first of that type in the United Kingdom, and still do useful work with goods trains over the severe grades of the main lines. His 4–4–0 locomotives also do a considerable amount of work; though they are outclassed for certain duties, they nevertheless do a large amount of hard work on the express service. Chief interest, pending the appearance of Mr. F. G. Smith's enlarged 4–6–0 engines, under construction by Messrs. Hawthorn Leslie & Co., Ltd., lies in Mr. Peter Drummond's "Castle" (4–6–0 engines) and his enlarged "Ben" class (4–4–0), for the heaviest duties; his 0–6–4 banking tank engines; and the small "Ben" (4–4–0) and 0–6–0 goods designs for general service. Including all engines of the various types, the following tender engines are in service: 31 (4–6–0), 77 (4–4–0), 4 (2–4–0) and 12 (0–6–0). The tank engines stock includes 6 (0–6–0), 5 (0–4–4), 8 (0–6–4), 8 (4–4–0) and 1 (2–4–0). Most of these designs are well known, so that there is no need for describing them in detail; but we may give the leading dimensions of Mr. Smith's forthcoming main line locomotives, which will be numbered 70–75 inclusive. Outside cylinders will be 21 in. by 28 in.; coupled wheels, 6 ft. diam.: heating surface —firebox, 139·6 sq. ft., tubes, 997 sq. ft.



0–6–4 BANKING TANK ENGINE NO. 39.

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(2 in. tubes) and 463 sq. ft. (5 in. tubes); and grate area, 25·3 sq. ft. They will have Belpaire fireboxes, Schmidt superheater and Mr. Smith's special feedwater heating apparatus.

Passenger rolling stock on the Highland Railway is good and comfortable, but not ornate. There are 213 carriages of uniform class and 94 composites, all modern ones being of bogie types, and 2 sleeping cars used between Inverness and Glasgow. Other coaching stock includes 11 post-office vans, 102 luggage, parcel and brake vans, 50 carriage trucks, 31 horse-boxes, and 302 miscellaneous vehicles. Goods rolling stock is necessarily of an ordinary character, there being no traffic, unless it be the conveyance of fish, calling for special provision. There are 1,824 open wagons of 8–12 ton capacity and 75 of 12–20 classes; 182 covered wagons (8–12 tons) and 6 (12–20 tons); 5 special wagons; 292 cattle trucks; 190 rail and timber trucks; 67 brakevans and 1 miscellaneous vehicle. There are 108 vehicles reserved for service use.

A special feature on the Highland Railway is the number of houses and cottages built for the use of employés, in many cases in locations where no village is adjacent to the line at places where staff accommodation is required. Of these there are 473, usually erected in blocks of four to designs which have become more or less standard.

Facilities.

Normally the Highland gives a good many useful facilities. Tourist tickets from England allow almost all "break-of-journey" facilities likely to be required, and the same applies to many of the long distance excursion arrangements. Local excursion tickets are often issued, and many arrangements operate in conjunction with steamer and coach services in the districts served by the Highland Railway, and a wide selection of circular tour facilities are available. Golfing and fishing interests are largely considered. Timber, coal, cattle and fish are the principal items other than passenger traffic dealt with; but apart from its work in meeting the demands of the districts served, and beyond the cattle and fish traffic which are of special importance, the Highland is essentially a passenger carrying railway, suffering moreover from exceptional difficulties now that so much of that traffic is of a "rush" character, very heavy and complicated at certain periods, and slack at others, and furthermore in so many instances dependent upon the connections with the southern Scottish and the English railways as regards long distance journeys. It is, however, a well-managed and operated line, "unique" in many ways, and full of interest, scenically and otherwise, to the traveller. When first constituted the Highland Railway set out to provide mainly for local requirements; since then it has opened up "The Highlands" to travellers and tourists from all parts of Great Britain, and during the fifty years of its existence under its present title the Highland Railway has realised a record which amply justifies the attainment of its "Jubilee," being recognised as a notable event in the history of railways in the British Isles. The pity is that it could not be celebrated as it would no doubt have been in happier times. Nevertheless, we have pleasure in placing the main facts on record, and of expressing our meed of appreciation of the development of the Highland Railway in the hands of those chief officers who have assisted therein during its now lengthy and creditable history.

A few remarks in reference to the personnel of the present chief executive staff will appropriately conclude this article.

Mr. Robert Park, General Manager and Solicitor, was born in Edinburgh in the year 1867, and was educated at the Edinburgh Academy, afterwards attending the law classes in the Edinburgh University. In 1883 he began training for the Law profession in the office of Messrs. Dove, Lockhart, and Smart, S.S.C., Edinburgh, and was in their office for about ten years, having passed through the various departments, including accounting and joint stock company work. In 1893 he went to St. Andrews as assistant to Mr. J. L. Macpherson, Solicitor, there, and remained with him till 1898, when Mr. Park commenced business on his own account as a solicitor in Coatbridge. He was appointed Secretary of the Highland Railway in February, 1901, and Solicitor in 1903, which positions he held until the end of 1910, when he succeeded Mr. T. A. Wilson as General Manager, at the same time retaining the office of Solicitor.

Mr. Thomas McEwen, Traffic Manager, entered the service of the Glasgow and South Western Railway, as a junior clerk in 1874. His first seven years of service were spent in clerical training at a number of stations, as Booking Clerk, Goods Clerk, and Mineral Clerk. For the next seven years he occupied the position of Relief Stationmaster.

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Thomson] [Inverness.

MR. H. H. WARD.
Hotels Manager.

During the next four years Mr. McEwen held the position of Chief Staff Clerk in the office of the Superintendent of the Line, and then for three years he was assistant to the Marine Superintendent. Eventually he became Chief Clerk, or Assistant to the General Manager of the Glasgow and South Western Railway, until he joined the Highland Railway on January 14th, 1901.

Mr. Frederick George Smith, Locomotive, Carriage and Wagon Superintendent, commenced his railway career as a pupil under Mr. T. W. Worsdell at the North Eastern Railway Works at Gateshead, finishing in the Drawing Office. He was then, for seven years, assistant in various departments and at the Running Sheds at Gateshead, Middlesbrough, Shildon, Blaydon, etc. Leaving the North Eastern Railway Mr. Smith was for four years with private firms in England as Chief Mechanical Engineer in Electrical Works. In 1903 he was appointed Works Manager of the Highland Railway, succeeding Mr. Peter Drummond as Locomotive, Carriage and Wagon Superintendent in 1912.

Consequent upon the appointment of Mr. P. Drummond as Locomotive Superintendent of the Glasgow and South Western Railway in 1912, and the appointment of Mr. F. G. Smith as Locomotive Superintendent of the Highland Railway, Mr. T. Brown was selected to fill the new position of Assistant Locomotive Superintendent. Mr. Brown is the son of the late Thomas Brown, Chief Locomotive Inspector, North British Railway. He was educated at the Edinburgh Institution, and trained as an engineer in the workshops of the North British Railway at St. Margaret's (Edinburgh) and Cowlairs (Glasgow). In subsequent years he served as Locomotive Foreman and then as Erecting Shop Foreman at St. Margaret's; later he was appointed Locomotive Foreman at Berwick, which position he vacated to go to Inverness.

Mr. Alexander Newlands, M.I.C.E., Engineer-in-Chief, is a native of Elginshire, and entered the service of the Highland Railway Company in 1892, on the completion of his apprenticeship. He was at first attached to the Head Office staff, and having been engaged in the parliamentary work of the Kyle Extension Railway (10 miles) of the Dingwall and Skye section of the line, including the Deep Water Pier at Kyle of Lochalsh, he was in 1893 appointed Resident Engineer on these works, and saw them completed in 1897. In 1897 he was appointed Resident Engineer on the widening of the Highland main line. In 1898 he was appointed Chief Engineering Assistant, and in 1901 became Assistant Engineer. On the retirement of Mr. W. Roberts in January, 1914, he was appointed Engineer-in-Chief.

Other appointments which may be specially mentioned are those of Mr. G. T. Cornet, Secretary and Registrar; Mr. Alex Macdonald, Accountant; Mr. L. McLaren, Telegraph Superintendent; Mr. E. F. Lowe, Signal Superintendent; Mr. J. Sutherland, Factor and Commissioner; Mr. D. Butter, Cashier; Mr. C. Kennedy, Stores Superintendent; and Mr. H. H. Ward, Hotels Manager.

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The Progress of the Great Western Railway from Oxford to the Mersey. [No. III.].

By HERBERT RAKE.

E. THE SHREWSBURY AND BIRMINGHAM RAILWAY (*continued*).

A GREAT meeting was then called at Wolverhampton, and the project of the Shrewsbury and Birmingham Railway was referred to as having originated with the idea of securing for the district two independent lines of railway to Liverpool and Chester. The line would be valueless to the London and North Western Company, as they already possessed lines in whichever direction the Shrewsbury Company had connections. Irreparable injury would be inflicted on the Staffordshire and Shropshire coal and iron masters if the district was to be enveloped in a railway monopoly, when a through traffic communication with the ports of the Mersey could be effected by a working arrangement with the Great Western Company, who were then completing their line between Birmingham and Oxford, which would give them a separate and independent line all the way to London.

The meeting concluded with a resolution to adopt a memorial to the Board of Trade, drawing attention to the inconvenient situation of the London and North Western station, one mile distant from Wolverhampton,* and for a year past that Company had delayed the completion of the Stour Valley line, which had a station close to the town and had thereby prevented a junction of the Shrewsbury and Birmingham Company with the Great Western Railway.

During the autumn of 1851 a special meeting was held at Shrewsbury to consider the Bills before Parliament for making a line between Priestfield Junction and Wolverhampton, to connect the Shrewsbury and Birmingham line with the Stour Valley and Birmingham, Wolverhampton and Dudley lines. The Bill sought to finish the portion of the Stour Valley line near Priestfield at the expense of the London and North Western Company. The Great Western, being anxious to open a communication with the Stour Valley, purposed continuing a line on the broad gauge to Wolverhampton, where a junction was to be effected with the Shrewsbury and Birmingham Railway.

F. THE SHREWSBURY AND CHESTER RAILWAY.

This line was formed by an amalgamation of the North Wales Mineral Railway and the Shrewsbury, Oswestry and Chester Junction Railways. The former was incorporated in 1844 (Act 7 and 8 Vict. Cap. 99) for a line from Saltney Junction, on the then Chester and Holyhead Railway, to Wrexham, and was subsequently extended to Ruabon in 1845. There were also some mineral branches in the neighbourhood of Wrexham. In 1846 an Act was obtained for additional branches. The line to Ruabon was opened on December 2nd, 1846. The total length of the line was about 25 miles.

The latter was incorporated on June 30th, 1845, for a line continuing the North Wales Mineral Railway to Shrewsbury, with a branch from Gobowen to Oswestry, the object being to receive a tributary stream of traffic from the Shrewsbury and Birmingham Railway, and also to provide for the requirements of a rich agricultural population in the conveyance of Shropshire farm produce and live stock to the Manchester and Liverpool markets, while at the northern end the Company obtained access to the Wrexham and Ruabon coal fields of the North Wales Mineral Railway, and by using the Chester and Holyhead Company's line between Saltney Junction and Chester, for which they paid toll, came into connection with the Chester and Birkenhead Railway.

In 1846 the Company procured powers for the construction of branches to Crickheath and Wem on the Crewe and Shrewsbury line, of the London and North Western Railway, but these branches were afterwards abandoned.

The first meeting of the Company was held at Chester on September 19th, 1845,

* This station was the original station on the Grand Junction Railway. It was afterwards called Wednesfield Heath on the London and North Western Railway and is now only a goods station.

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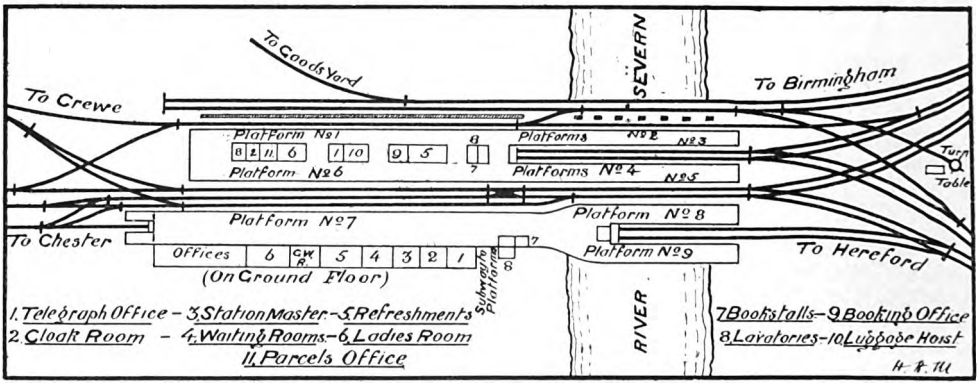
when the Directors announced that they had entered into a contract with Mr. Brassey for the completion of the work within the Parliamentary estimate, and that operations had already been commenced at the approaches to the viaduct over the river Dee. At a special meeting held on November 14th, 1845, amalgamation of the North Wales Mineral and the Shrewsbury, Oswestry and Chester Railways was agreed to, and a continuous railway was thereby secured. This amalgamation, which took place in 1846 (9 and 10 Vict. Cap. 151) authorised a nominal increase of the value of the North Wales Mineral shares of 33½ per cent. in excess of the nominal value of the Shrewsbury and Chester shares. The conjoined companies then became known as the "Shrewsbury and Chester Railway Company." The North Wales Mineral Company, however, was to pay its own dividends and be worked as a separate concern until the Shrewsbury line should be opened for traffic. The first meeting of the joint Companies was held on October 26th, 1846.

In 1847 the Shrewsbury and Chester Company obtained powers to construct, along with the London and North Western, the Chester and Holyhead, the Chester and Birkenhead, and the Birkenhead, Lancashire and Cheshire Junction Railways, with a joint station at Chester (opened in 1848) and in 1849 the Company was authorised to make a branch to and a wharf at Saltney, near Chester, also to contribute a proportion of the expense of a joint station at Shrewsbury and to contribute a sum not exceeding £75,000 to the Shrewsbury and Hereford Railway, whereby they secured a share in the direction of the latter Company, in order to enable the establishment of a through route from Liverpool to Bristol and the West of England in connection with the Great Western Railway and also the mining districts of South Wales in co-operation with the Newport, Abergavenny and Hereford, Monmouthshire and other railways.

In the meantime the works between Ruabon and Shrewsbury were being rapidly proceeded with, and during 1848 the line was so far advanced that the bridges over the Ellesmere Canal and the river Perry were ready for traffic, the Chirk viaduct over the Shropshire Union Canal being nearly completed, while the Great Dee viaduct was also making good progress. This viaduct, which crosses the Dee in the Vale of Llangollen, about half a mile south of Cefn, and 1¾ miles south of Ruabon, consists of nineteen semicircular arches of 60 ft. span, built with a double ring of arch stones 4 ft. deep. Height from the bed of the river to the top of the parapet at the centre pier is 148 ft. The piers are 13 ft. thick and 28 ft. 6 in. long at the springing of the arch, with a curvilinear batter or slope on the face. The structure is founded on solid rock and built of stone, with the exception of the interior arching, which is of hard fire-bricks. The length of the viaduct is 1,532 ft. and its construction involved upwards of 64,000 cubic yards of solid masonry, the cost being about £76,000. It was erected under the direction of Mr. Henry Robertson, engineer to the Shrewsbury and Chester Railway. The first stone was laid on April 19th, 1846, and the last arch closed on August 12th and keyed on August 25th, 1848.



PLAN OF SHREWSBURY JOINT STATION.

The main line between Ruabon and Shrewsbury was opened to the public on October 14th, 1848, and the Oswestry branch in December of the same year. The original locomotive and carriage works were erected at Saltney, owing to the company only

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having the usage of the line between Saltney and Chester by paying toll to the Chester and Holyhead Railway Company.

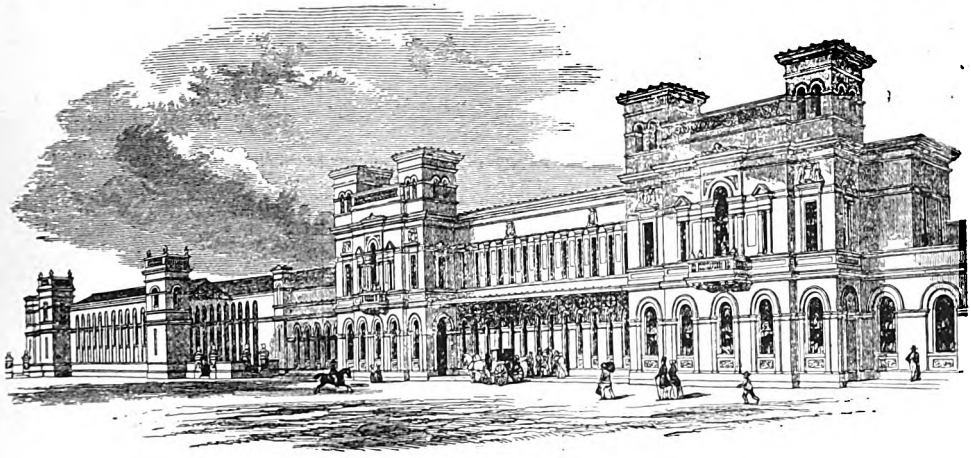
On Monday, May 24th, 1847, a serious accident occurred to a Shrewsbury and Chester train, which left Chester at 6.30 p.m. When crossing the Chester and Holyhead railway bridge over the Dee, at the extremity of Chester race course, the bridge gave way and the whole of the train, with the exception of the engine and tender, fell into the river, with the result that five persons lost their lives and many others were seriously injured. The train consisted of one first-class, two second-class carriages, and a luggage van.

On April 26th, 1849, a special meeting was convened to consider a Bill before Parliament to enable the Birkenhead, Lancashire and Cheshire Junction Railway to lease or sell their line to the London and North Western Company, the Chester and Holyhead, or the Shrewsbury and Chester Railways, severally or collectively; but the latter declared they would be no parties to the matter in any way.

In 1850 a dispute arose with the London and North Western Railway as to the rates between Wolverhampton and Liverpool. The Shrewsbury and Chester, in conjunction with the Shrewsbury and Birmingham Railway, had at Chester the choice of three separate communications with Liverpool and Birkenhead, and this fact enabled a reduction of the rates to be made as compared with those formerly charged by the London and North Western when they had the whole of the traffic in their hands.

The routes now available, all competing for the Mersey trade, were the Chester and Birkenhead Railway, the Birkenhead, Lancashire and Chester Junction Railway, with the bridge over the Mersey near Runcorn, and the Ellesmere Canal *viâ* Ellesmere Port to Liverpool. There was also the river Dee navigation by boat the whole way, this being the cheapest of all, though necessarily the least expeditious mode of transit.

Finding their efforts to get a revision of through rates effected, either by persuasion or threat, quite unavailing, the London and North Western sought to acquire the Shrewsbury and Chester Railway under a provisional lease to be confirmed by Parliament at a rental of 4 per cent. per annum and half surplus profits; but it became evident that the natural ally of both the Shrewsbury Railways was the Great Western, who were in a position to offer through traffic of a non-competitive character, while that of the London and North Western could only be in the nature of traffic already provided for and which would therefore have to be shared with one of their other routes.



GENERAL STATION, CHESTER.
(*From an old print.*)

In 1851 an Act (14 and 15 Vict. Cap. 131) was obtained for making a station on the South Reserve at Birkenhead, and giving very extensive powers for running over the Birkenhead, Lancashire and Cheshire Junction Railway, and for the conveyance and interchange of traffic between that company, and the Shrewsbury and Birmingham and Shrewsbury and Hereford Companies. The Act also provided that an agreement might be made with the Shrewsbury and Hereford Company for its use and working by the

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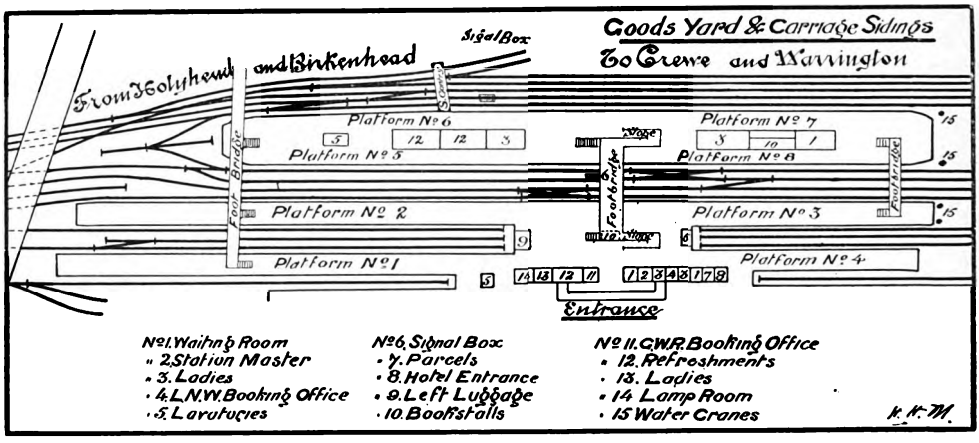
Shrewsbury and Birmingham Company. By the last-named Act power was obtained to abandon the Crickheath and Wem branches already referred to.

The erection of a separate station on the South Reserve was rendered necessary by the obstructions offered by the London and North Western and other lines to the Shrewsbury and Chester Company in carrying their traffic to Birkenhead and Manchester, and to make ample provision for the increased traffic that would flow to Birkenhead on the completion of connection with their southern allies.

Negotiations had been satisfactorily concluded with the Warrington and Altrincham Railway in connection with the company's running powers over the Birkenhead Lancashire and Cheshire Junction Railway, which it was found would give the Shrewsbury and Chester Railway an independent and shorter route to Manchester, and naturally afforded the London and North Western Railway another source of provocation.

The Stour Valley line was opened on July 1st, 1852, for London and North Western local trains only, and so great were the obstructions offered to the Shrewsbury and Chester Railway traffic that it was felt there could be no practical relief to the traffic delays until the completion of the lines of the Great Western and South Staffordshire Railways, when the proposed working agreements with the latter railway could be effected.

A resolution was passed at a special meeting held July 17th, 1851, authorising the Directors to make arrangements with the Birkenhead, Lancashire and Cheshire Junction Railway, in conjunction with their allies, the Great Western and Shrewsbury and Birmingham Railways, to negotiate with the Birkenhead Company for a lease of their line from July 1st, 1851, at an ultimate fixed rate of 4 per cent. The traffic of the associated companies was in the meantime to be worked over the Birkenhead line at a percentage on receipts, and the Birkenhead Company were to have the option of amalgamation at the end of the fourth year. To carry out the arrangement, a Bill was brought into Parliament, but the Great Western Railway having stated that the arrangement on their part was that the lease was to be contingent on the amalgamation of the three companies, and the Birkenhead Company having maintained the contrary, the negotiations came to an end.



PLAN OF CHESTER JOINT STATION (LONDON AND NORTH WESTERN AND GREAT WESTERN RAILWAYS).

A Bill was afterwards introduced to provide for the amalgamation of the two Shrewsbury Companies with the Great Western, thus forming a continuous route to Chester. This Bill was opposed by the London and North Western Railway, and was thrown out owing to non-compliance with Standing Orders, as also was the Bill for working agreements with the Birkenhead, Lancashire and Cheshire Junction, the Shrewsbury and Hereford, the Hereford, Ross and Gloucester, and the Newport, Abergavenny and Hereford Railways. Meanwhile the Birkenhead, Lancashire and Cheshire Junction had concluded a provisional agreement with the London and North Western Railway, under a guarantee of 4 per cent., to take effect from December 31st, 1852.

The Great Western Railway directors had

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proposed to deposit a Bill for the lease of the former line, but the Shrewsbury and Chester Company passed a resolution to the effect that they were no parties to a lease to the Great Western Company. At the end of 1852 the position of the Shrewsbury Railways with reference to the two larger companies was as follows :—The Great Western confirmed its arrangement for an amalgamation at a given period to be thereafter agreed upon, offering meanwhile a guarantee commencing at 3 per cent., with an ultimate rise to 3½ per cent. and half surplus profits. They required, however, running powers to Chester, and also authority to lay the broad gauge throughout. The London and North Western Company proposed to "ask permission" from Parliament to offer, at its own discretion, a present guarantee of 4 per cent., with a contingent rise to 4½ per cent. At the same time they demanded a restitution of the original rates and an equality of charges at competitive points.

On February 1st, 1853, a special meeting of shareholders was convened at Shrewsbury, when it was decided to oppose the Great Western Company's Bill unless materially amended with regard to the power proposed to be sought for laying down the broad gauge over their line to Chester. It was stated that the Shrewsbury and Birmingham Company would also oppose the broad gauge being extended beyond Wolverhampton. A second special meeting was held on September 12th, 1853, to consider the terms offered by the London and North Western and Great Western Companies respectively, and it was agreed that an alliance should be entered into with the latter company subject practically to the confirmed arrangement above referred to.

The trains of the Shrewsbury and Birmingham Company commenced running over the Stour Valley line into New Street, Birmingham, on February 4th, 1854, and from the report presented at the half-yearly meeting held at Chester on March 29th, 1854, it was shown that passengers were then conveyed to Birmingham from Birkenhead and from London without change of carriage. At Birmingham they were conveyed free of charge between the Stour Valley (New Street) and Great Western (Snow Hill) stations to meet trains running in connection. The broad gauge line *viâ* Dudley was not then completed through to Wolverhampton, and the break of gauge was consequently at Birmingham. For the journey of 228½ miles between Birkenhead and Paddington (*viâ* Oxford and Didcot) express trains making 14 stoppages occupied in 1854 about 6½ hours, a very creditable performance. At the present time the journey *viâ* Bicester, a distance of 210¼ miles, is accomplished in 4 hr. 50 min., with four stops and one slip between Paddington and Chester.

Eventually the Great Western Railway formally took possession of the Shrewsbury and Chester Railway on September 1st, 1854.

G. The Birkenhead Railway.

This railway, the main line of which runs from Chester *viâ* Hooton to Birkenhead, was originally an amalgamation of (1) a railway incorporated under the title of the Chester and Birkenhead Company, and (2) a railway incorporated under the title of the Birkenhead, Lancashire and Cheshire Junction Company. Under an Act obtained in 1847, these two companies were amalgamated under the title of the latter company. These original lines will be dealt with sectionally, before considering the Birkenhead Railway proper.

The Chester and Birkenhead Railway was incorporated by an Act passed on July 12th, 1837, with a share capital of £250,000 and borrowing powers to the extent of £83,333. By two subsequent Acts passed in 1840 and 1845 the share capital was raised to £675,000 and the borrowing powers to £224,999. The line was opened as a single one on September 22nd, 1841, when as a result of negotiations, the Postmaster-General ordered the London mails for Dublin to be forwarded *viâ* Chester to the Birkenhead Packet station at Birkenhead. In 1845 it was decided to double the whole line and so arrange the space between the up and down lines that they could be adapted for the broad gauge if required.

The original Birkenhead, Lancashire and Cheshire Junction Company was incorporated by an Act dated June 26th, 1846, with a share capital of £1,500,000 and borrowing powers to the extent of £500,000 for the construction of various lines in Lancashire and Cheshire amounting in all to about 47 miles, of which only 16 miles 62 chains were completed, namely the line between Chester and Walton Junction (near Warrington), where it joined the London and North Western Railway. The remainder of the projected lines were abandoned. The section mentioned was opened on December 18th, 1850.

At a meeting held at Birkenhead on May 19th, 1849, it was agreed to lodge a Bill in Parliament for a line from Hooton to Helsby,

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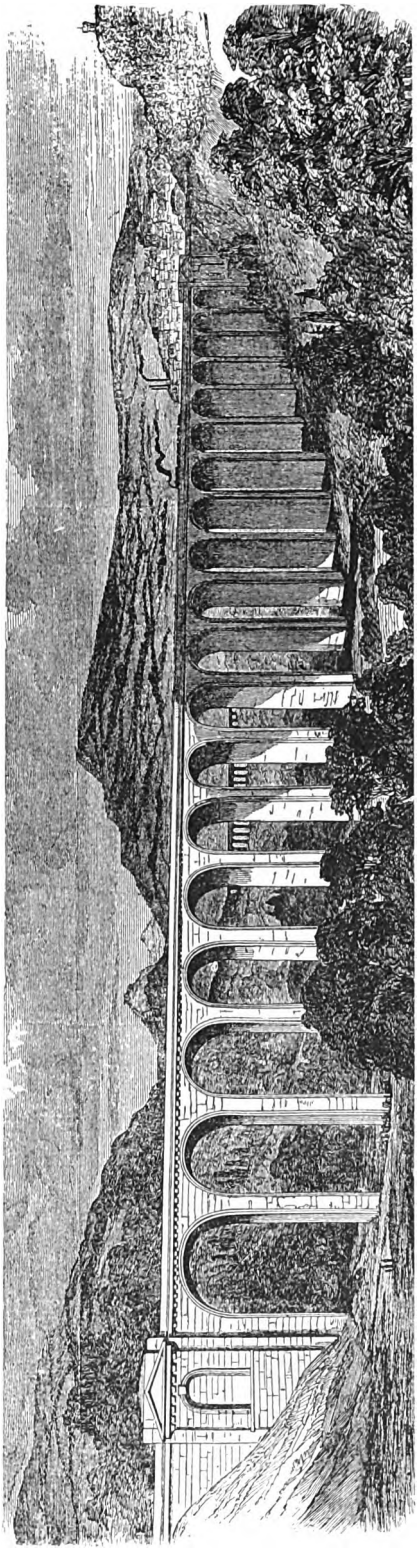

THE DEE VIADUCT ON THE SHREWSBURY AND CHESTER RAILWAY.
(From *The Illustrated London News*, October 21st, 1848.)

where it would meet the Chester and Walton Junction line. Owing, however, to difficulties which overtook the railway companies in 1848 and 1849, this line was abandoned and the undertaking limited to the Chester and Birkenhead and Chester and Walton Junction lines.

In the same year as the Chester and Birkenhead Railway was incorporated, another project was advanced called the Chester Junction Railway, for what was stated to be a shorter and better route to connect the Grand Junction Railway at Crewe with Birkenhead direct, but this scheme was abandoned at the last moment. By an Act dated July 1st, 1852, the joint undertaking above referred to was dissolved and incorporated anew under the same title. This Act enacted that the new company should be limited to the works, at the date of the Act, vested in the dissolved company, or authorised, *viz.*, (1) the line from Chester to Grange Lane (now a mineral yard); (2) Grange Lane to Monks Ferry; (3) Grange Lane to Bridge End (now Cathcart Street goods station); (4) a one-fourth share of Chester station*; (5) the line from Chester to Walton Junction.

By an Act dated August 1st, 1859, the company was authorised to change its name to "The Birkenhead Railway" and to make branches from Hooton to Helsby, and from Grange Lane to Tranmere Pool (both opened, July 1st, 1863). By Act 24 and 25 Vict. Cap. 134 (1861) the line was vested jointly in the London and North Western and Great Western Railways. Subsequent to this Act the two owning companies have constructed the following lines:—(1) Hooton to Parkgate, opened October 10th, 1866; (2) Parkgate to West Kirkby, opened April 19th, 1886; and (3) Grange Lane to Woodside Ferry, with a terminal station at Woodside, opened in April, 1878.

The general course of the line was laid out with curves never less than a mile radius, and the steepest gradient was 1 in 100 for 30 chains at Birkenhead; otherwise the ruling gradient was 1 in 330 for 2 miles 40 chains between Mollington and Capenhurst. Cuttings on the line amounted to 1,200,500 cubic yards, the largest, involving 240,000 cubic yards, being at Derby House about three miles from Birkenhead. The principal embankment was that at Moston, about four miles from Chester, containing 365,000 cubic yards.

* This has been referred to in the section referring to the Shrewsbury and Chester Railway.

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Moston viaduct—the heaviest work of the kind—carrying the line over the Shropshire Union Canal, consists of eleven arches and is 41 ft. in height above the surface of the water, the piers being of red sandstone and the arches of brick. A gauge of 4 ft. 9 in. was adopted and the rails were of single parallel form weighing 56 lbs. to the yard, set in chairs and secured thereto by a ball and key. The chairs were secured to cross sleepers of larch and Scotch fir with ¾ in. spikes 7 in. long.

The original locomotives of the Chester and Birkenhead line were four in number, built in 1840 by Mather, Dixon and Co., of Liverpool. They were six-wheeled engines with 5 ft. 6 in. single drivers, and 12 in. by 18 in. cylinders. One of their peculiarities was that they possessed two domes. No. 3 was named *Touchstone.*

Two other locomotives, No. 9 *Victoria* and No. 10 *Albert*, were built in 1845 at the Vulcan Foundry by Tayleur and Co. They were also six-wheeled engines, with 5 ft. 1 in. single drivers and cylinders 13 in. by 18 in. Nos. 11 *Birkenhead* and 12 *Chester* were built by B. Hick and Son of Bolton, in 1848. They were 5 ft. 6 in. coupled goods engines with cylinders 16 in. by 24 in. Their names were afterwards changed to *Blazer* and *Gnome*, respectively. The same firm in 1851 also constructed six outside cylinder engines. They were six wheel engines with single drivers 6 ft. in diameter with 15 in. by 22 in. cylinders, and were numbered 15 to 20 inclusive. Two passenger engines, Nos. 25 *Birkenhead* and 26 *Weaver* were supplied by R. Stephenson and Co. in 1853. They were six-wheeled engines with coupled wheels 4 ft. 3 in. in diameter and cylinders 14½ in. by 20 in.

In 1842 arrangements were made with the London and Birmingham and Grand Junction Railways, by which passengers were booked through from London to Birkenhead and *vice versa.* In the autumn of 1850 an announcement was made that it was the intention of the Shrewsbury and Chester and Shrewsbury and Birmingham Railways to ask for powers in the next Session of Parliament to purchase land at Birkenhead and to use the Chester and Birkenhead line at certain reduced rates, and in the Session of 1851 they were accorded running powers into Birkenhead.

The London and North Western Company had, it appeared, been attempting to secure the Shrewsbury and Birmingham and Shrewsbury and Chester Railways, which would have intercepted the natural flow of traffic to the south of the Mersey. The Great Western therefore came forward with their Shrewsbury allies, the "Associated Companies," to make overtures for a working agreement with the Birkenhead Company, but the terms offered were not such as the latter felt able to accept. Moreover, they had an agreement in force with the London and North Western Company which it was not in their interest to allow to be cancelled, though that railway was willing to do so.

Under their original Act of 1846 the Birkenhead, Lancashire and Cheshire Junction Company had secured running powers over the London and North Western Railway from Walton junction to Manchester *viâ* Warrington and Newton-le-Willows, with the right to a terminal station of their own in that city, and by means of a proposed railway called the Birkenhead and Holyhead Junction Railway, which was to cross the estuary of the Dee opposite Flint, it was thought to open up a direct communication with the Chester and Holyhead Railway for the purpose of obtaining a more direct route for the Irish traffic.

Combinations proposed by the various railways between Chester and the south brought the Birkenhead Railway Board into communication with the Great Western Company, who were desirous of acquiring the line to Birkenhead as a portion of their own contemplated through route from Birmingham and Chester. As a result the Great Western Company offered to lease the Birkenhead Company on a guarantee of 3 per cent. increasing to 4 per cent. per annum thereafter in perpetuity, or the option was to be given to the Birkenhead Company to enter into the proposed amalgamation with the Shrewsbury and Birmingham and Shrewsbury and Chester Railways.

At a special general meeting in the autumn of 1851 the directors laid before the proprietors the memorandum of agreement provisionally entered into to lease the line to the Great Western and the Associated Companies, which after a protracted discussion was carried, but there was an influential minority who wished to adhere to the London and North Western Company, and not jeopardise the hitherto friendly relations existing therewith.

Traffic arrangements had been entered into with the Chester and Holyhead Railway by which the latter were to pay a rent of £3,000 a year for the use of the Birkenhead

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a new stipulation into the Agreement that the leasing of the Birkenhead Company was not to be proceeded with until the Bill for securing the amalgamation of the Associated Companies had passed through Parliament, and the sanctioning of the entire withdrawal of the Birkenhead Company from the Bills before Parliament was now unanimously agreed upon.

Towards the end of 1850 the Birkenhead Company held a meeting for the purpose of considering and approving of an agreement for the working of the Railway by the London and North Western Company in conjunction with the Chester and Holyhead Company as their traffic would be of the greatest advantage. It was proposed that the London and North Western Company should take over the working arrangements of the Chester and Walton junction line, the latter (*i.e.*, the Birkenhead Railway Company) reserving the entire control of the local traffic. A Bill to enable the London and North Western Company to lease the Birkenhead Railway was lodged in Parliament in 1853. The Great Western Company naturally opposed, with the result that the Bill was rejected. Meanwhile a large proportion of the Holyhead traffic for Birkenhead Docks passed over the Chester and Birkenhead line. The Great Western Company then promoted a Bill of their own for access to the Mersey, with the powers to lay down the broad gauge over the Birkenhead line if required; but the Birkenhead threatened the most strenuous opposition and the Bill was withdrawn.

In the autumn of 1854 the Great Western Company made an offer not to object to any agreement that might be arrived at as to the traffic of the Chester and Holyhead Company being treated on the same terms as their own. The feeling of the Birkenhead Company was against any further attempt at a working agreement, leaving the Great Western Company to exercise such running powers as they were entitled to.

During 1855 a working agreement was entered into with the London and North Western Railway under which there was to be a joint occupation of the Warrington and Manchester stations, the Yorkshire traffic being secured to the Birkenhead Company in addition to that from Manchester to Chester and North Wales. The Great Western Company then gave the Birkenhead Company notice to refer the terms for terminal accommodation at Birkenhead to arbitration, as provided under the Act of Parliament, and the terms were settled in 1856.

In 1859 the London and North Western and Great Western Companies entered into an arrangement that, as from January 1st, 1860, the two companies should assume the Birkenhead debenture stock, mortgage debt and liabilities on capital account, not exceeding in whole £512,000, the two companies paying half-yearly dividends as from January 1st, 1866, on the Birkenhead Ordinary Capital of £1,941,505.

The leasing companies took possession of the line on November 18th, 1860, and by Act 24 and 25 Vict. Cap. 134 (1861) the line was finally vested in the two leasing companies as before stated.

In conclusion the writer desires to express his thanks to Mr. Henry H. Meik for references, maps, and the loan of several prints to illustrate what is generally regarded as an exceptionally interesting chapter of railway history.

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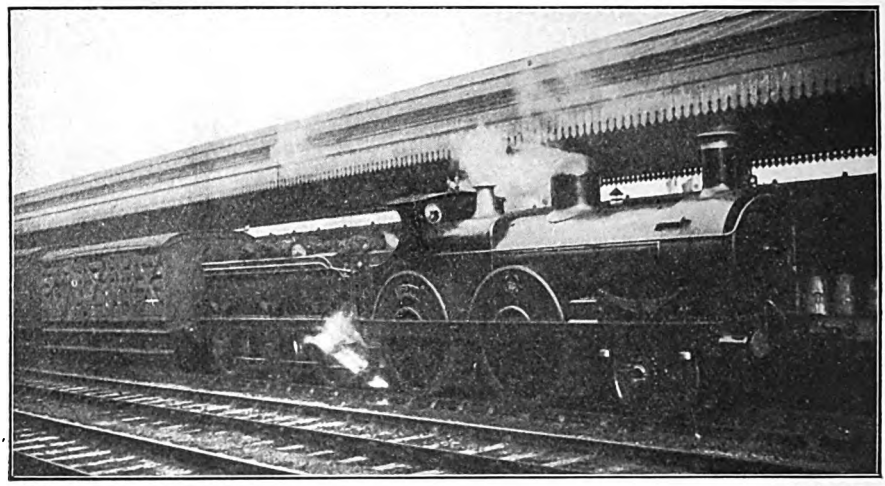

Photo] [*T. Geary.*

2-4-0 LOCOMOTIVE NO. 2211, ON STOPPING TRAIN AT SNOW HILL, BIRMINGHAM.

The Railways of South Staffordshire.

II.—GREAT WESTERN RAILWAY LINES.

By PHILIP F. GROVES.

IN the Birmingham and Wolverhampton area the Great Western Railway has many lines which rank highly for traffic importance, particularly in respect of suburban and industrial routes. First there is the main line from London to Birmingham, Wolverhampton, Shrewsbury, Chester, and Birkenhead, and which comes within the district under consideration as regards the section between Codsall station and Birmingham. Codsall is a small station 5½ miles north-west of Wolverhampton, with a train service of fourteen down (from Wolverhampton) and thirteen up trains. There is one station between Codsall and Wolverhampton, known as Dunstall Park, and this station has the same trains as Codsall, except for two down trains which do not call at Dunstall Park. Some of the services between Wolverhampton, Dunstall Park, Codsall, and Albrighton (2½ miles from Codsall, and in Shropshire) are performed by rail-motors, which are extensively used in this district.

Dunstall Park station adjoins the Wolverhampton works of the Great Western where only repairs and "scrapping" are done, no new engines now being built here. A curious feature in connection with these works is that the best weighbridge in the district is at Tyseley, three miles the other side of Birmingham, and sixteen miles from the works, so that a contingent of engines is often sent from Wolverhampton to Tyseley for the purpose of being weighed, in all conditions of repair, some being absolutely without a vestige of paint, others just fresh from the paint shop.

Apart from the considerable amount of workmen's traffic entailed by the close proximity of the station to the works, there is another source from which a considerable amount of traffic comes to Dunstall Park, as it is the station for the Wolverhampton Races, Flower Show, and Annual Fête, all of which are held in the adjoining park from which the station takes its name. The possession of a station thus located gives the Great Western Railway a great advantage over the other railways, whose nearest station, Wolverhampton (High Level), is over a mile from the "scene of action."

A Great Western motor omnibus service is in operation between Wolverhampton and Bridgnorth, a station on the Severn Valley (Shrewsbury to Kidderminster) branch. The distance between the two places is fourteen miles, and a railway is under construction between them, but at present the motor 'bus service is a great boon to a district

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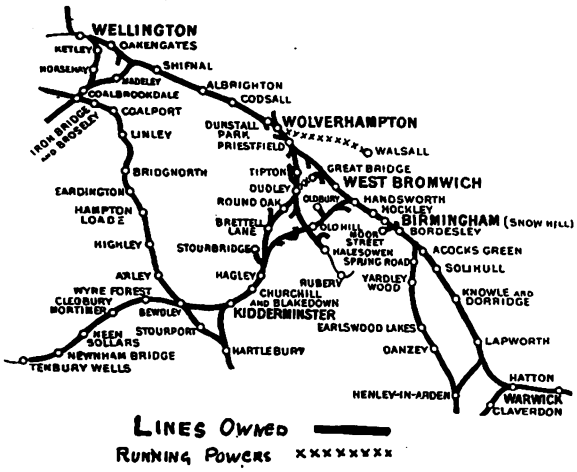


PLAN OF GREAT WESTERN RAILWAY LINES IN THE BIRMINGHAM AND WOLVERHAMPTON AREA.

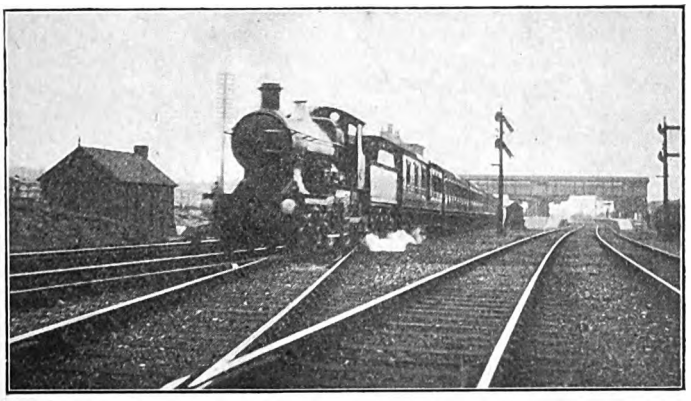
otherwise entirely without railway facilities. Four cars run in each direction daily, occupying 90 min. on the journey, *viâ* the villages of Wightwick, Shipley, Redhill, and Worfield, the termini being the respective stations at the two towns. On Mondays, Wednesdays, and Saturdays there was a service of two 'buses in each direction between Wolverhampton station and the villages of Wightwick, Nurton, Pattingham, and Claverley, in addition to the Bridgnorth service, but these are at present suspended.

Between Wolverhampton and Birmingham the Great Western Railway keeps on the north-east side of the London and North Western direct line *viâ* Dudley Port, and south-west of all the other routes between the two places. The Great Western line and the Dudley Port section of the London and North Western Railway are in no place as much as two miles apart.

Over this route there is a remarkable series of express trains. There are no fewer than 10 (13 in summer) non-stop expresses from Birmingham to Wolverhampton, seven with restaurant or tea car accommodation, besides one which calls only at West Bromwich, and two evening restaurant car trains which make several calls in order to suit business men returning from London or other centres and who would otherwise require to change at Snow Hill into local trains. Similarly the 6.50 a.m. breakfast car express from Wolverhampton calls at Bilston, Wednesbury and West Bromwich while there are 11 (14 in summer) non-stop trains from Wolverhampton to Birmingham, all but three having restaurant car or tea car accommodation, with several others which call several times.

Many of the non-stop trains are booked in 19 min. for the 12½ miles, and others in 20 or 21 min., by no means a bad record considering the character of the district traversed, and incidentally providing the fastest and most frequent express service between the two cities. Many of these trains are through London expresses, including certain which call several times between Wolverhampton and Birmingham, and where they are associated with the two-hour schedule between London and Birmingham, as many of them are, Wolverhampton is brought well within 2½ hours of the Metropolis—2 hours 24 min. in numerous instances, with a five minute stop at Snow Hill. There is only one train throughout the day which passes Wolverhampton without stopping, that being the continuation of the 11.5 a.m. from London, which runs from Birmingham to Shrewsbury without calling intermediately.

In some respects the Birmingham–Wolverhampton section may be considered as a traffic centre upon which many routes converge. Thus there are (1) trains starting from Wolverhampton to Birmingham and thence to London; (2) trains starting from



Photo] [*Felix E. Jones.*

GREAT WESTERN EXPRESS PASSING HANDSWORTH.
4-4-0 locomotive No. 3381, *Maine.*

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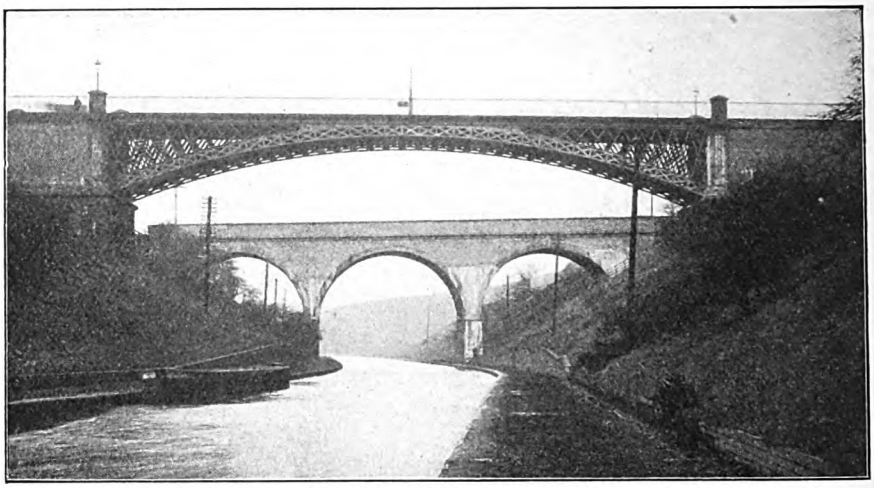

GALTON BRIDGE, SMETHWICK.
G.W.R. bridge in background, road bridge in foreground.

Birmingham or from Leamington, Stratford-on-Avon, or other places south thereof but of a relatively local character, and continued past Wolverhampton towards the north; (3) trains from Wolverhampton and Birmingham which continue over cross-country routes towards Bristol and Cardiff, in some instances going much further, as to Torquay and Penzance; and (4) through trains from north of Wolverhampton to south of Birmingham and which combine services already mentioned.

Some of the expresses represent what may be termed divisions of others, such as the 1.15 p.m. from Birmingham, which follows the 1.11 p.m. from Snow Hill, which itself omits Wolverhampton as already mentioned. There are also the through services to the London and North Western Railway *viâ* Wellington and Crewe, and the through Folkestone and Dover to Birkenhead expresses, all of these special through services concentrating upon the Birmingham–Wolverhampton section, and being involved in the notable series of non-stop or fast trains between the two stations concerned.

At Priestfield Junction station, 1½ miles from Wolverhampton, the Oxford, Worcester, and Wolverhampton line leaves the Birmingham and London line. Three-quarters of a mile further on Bilston station is reached, on both lines, this town having two stations, both Great Western. Bradley and Moxley, and Wednesbury (Great Western) stations are next passed, and the London and North Western Walsall and Dudley branch is crossed near Wednesbury (London and North Western Railway) before reaching Swan Village station, 6¾ miles from Wolverhampton. Here the branch from Dudley and Great Bridge comes in on the down side. Great Bridge is the only Great Western station on the branch, the line joining the London and North Western at Horsley Fields Junction as explained above. One of the enormous gasworks of the Birmingham Corporation is situated at Swan Village.

Handsworth and Smethwick station is the next point of note, West Bromwich being passed between Swan Village and Handsworth. Just north of Handsworth station the line from Stourbridge Junction, Kidderminster, Worcester, Malvern, and South Wales joins the Birmingham line, 10 miles from Wolverhampton, and 8 miles from Stourbridge Junction. Passing Soho and Hockley stations, and through a succession of cuttings and tunnels, the line reaches Birmingham Snow Hill station in 12¼ miles from Wolverhampton.

The train service at most of the stations between Wolverhampton and Birmingham is very good, as the following table shows:—

Station.	To B'ham. No of Trains.	From B'ham. No of Trains.
Wolverhampton (L.L.) ..	35	35
Priestfield	15	15
Bilston	21	22
‡ Bradley and Moxley ..	13	11
Wednesbury	22	24
Swan Village	27	29*
Handsworth & Smethwick	56	57†
Soho and Winson Green..	35	33†
Hockley	58	49†

* Including Dudley and Great Bridge trains.
† Including Dudley and Stourbridge line trains.
‡ Closed temporarily.

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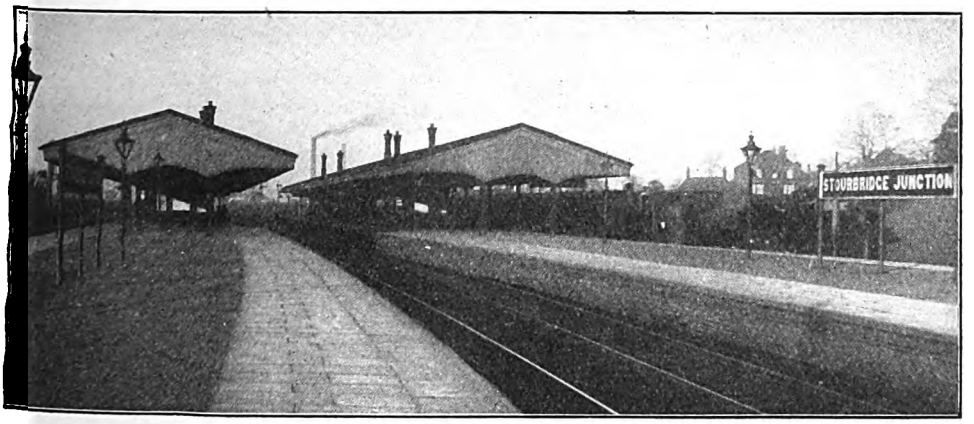
There are 15 trains from Birmingham to Dudley *viâ* Great Bridge, and 13 in the reverse direction.

Leaving the Birmingham and Wolverhampton, and Birmingham, Great Bridge, and Dudley routes at Handsworth and Smethwick station, the Stourbridge Junction line reaches Smethwick Junction station after passing over the London and North Western Railway near Galton Junction and crossing a canal, both lying in a deep cutting. At Smethwick Junction London and North Western through coaches are attached to and detached from some of the trains, as already set forth. Langley Green and Rood End is the next station, and is the junction for a short branch worked by a rail-motor to Oldbury, under a mile away. This branch is temporarily closed. This rail-motor performs a shuttle service of 33 trips in each direction daily, also making two trips to Smethwick Junction and back during the intervals in the Oldbury service. Smethwick Junction has 37 down and 33 up trains, Langley Green 30 both ways, and Rowley Regis (the next station, 6¾ miles from Birmingham), 29 down and 25 up trains.

Branches running to the two Worcestershire towns of Halesowen and Dudley, 1½ and 3¾ miles long respectively, leave the Stourbridge line at Old Hill Junction, 8 miles from Snow Hill. Between Rowley Regis and Old Hill is a curved tunnel. Between Old Hill and Stourbridge Junction (12¼ miles from Birmingham) there are two stations, Cradley Heath and Lye. These have each about 24 trains each way daily. *Old Hill* has 30 main line trains each way. On the Halesowen and Old Hill branch, which enters Worcestershire after passing through a tunnel ¼-mile from Old Hill station, there is an intermediate rail-motor halt at Coombs Holloway, not far from Messrs. Stewart & Lloyd's large tube works. The branch is single line, and there are 25 motor trips each way, with two extra late trips on Saturdays. New lines to serve works in the vicinity are in course of construction near Coombs Holloway, but after the above-mentioned tunnel the branch is amidst quite rural scenery, having left the "Black Country" at Old Hill.

Halesowen station is the terminus for Great Western motor service, and also for a service of trains over the Midland and Great Western Joint line from Northfield, 6 miles south of Birmingham over the Midland Birmingham, Worcester, Gloucester and Bristol main line. There are five trains each way between King's Norton and Halesowen, some being "mixed." The line is worked entirely by the Midland Company, although jointly owned.

The Dudley and Old Hill branch is also worked by rail-motors, with one or two trains, which latter run through to or from Birmingham *viâ* Smethwick Junction. There are two intermediate stations and three halts in the following order:—Old Hill High Street halt, Darby End halt, Windmill End, Baptist End halt, and Dudley (South Side). Between Baptist End halt and Dudley (South Side) the branch joins the Oxford, Worcester, and Wolverhampton Railway, though all the branch rail-motor trips are worked right through to Dudley (main) station. There are about 22 motor and train trips in each direction over this branch.



STOURBRIDGE JUNCTION, LOOKING TOWARDS DUDLEY.
Trains to Stourbridge Town use platform to the left.

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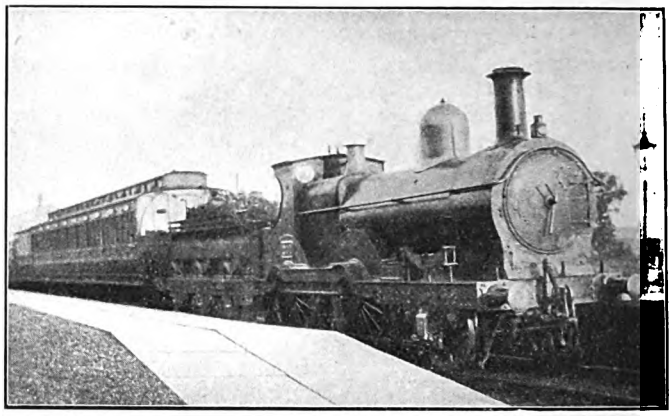
At Stourbridge Junction the Birmingham and Worcester line joins the Oxford, Worcester and Wolverhampton line, and the station is also the junction for a branch, to Stourbridge town just over the Worcestershire border, three-quarters of a mile long, normally worked by a rail-motor, though at present this is not operative. Under ordinary conditions, however, on this branch there are 53 motor and two train trips to the Town station, and 56 motor and four train trips to the junction, daily.



Photo] [*W. G. Partridge.*

2-4-0 LOCOMOTIVE NO. 201 ON STOPPING TRAIN IN TYSELEY STATION.

Returning over the same metals as those by which we should travel to Old Hill and Birmingham from Stourbridge Junction, these are soon left on the right, and after passing a large marshalling yard and locomotive depôt, Brettell Lane station is reached, followed by Brierley Hill and Round Oak. The latter is the junction for a private line known as the Shutt End Railway, which serves many collieries and brick works, the latter, especially those engaged in the manufacture of fire-bricks, being very common in the district. The line is not used for passenger traffic, though there is some talk of using it therefor.

From Round Oak the Great Western Railway continues to ascend steeply towards Dudley, the South Side station at that place being reached after passing Harts Hill and Woodside stations. Dudley main station is soon reached, 6½ miles from Stourbridge Junction. The London and North Western and Great Western stations at Dudley adjoin. Dudley (Great Western) station is the starting point and terminus of the services to Old Hill and Birmingham (*viâ* Great Bridge) referred to above.

Continuing from Dudley, after passing under the London and North Western Wolverhampton, Dudley Port and Birmingham line west of Bloomfield Junction, Tipton station is reached, whence to Priestfield Junction there are three stations—Princes End, Daisy Bank, and Bilston. At Priestfield the Great Western Railway Wolverhampton and Birmingham line is joined, Wolverhampton (Low Level) station being soon afterwards reached, 12 miles from Stourbridge Junction.

(*To be continued.*)

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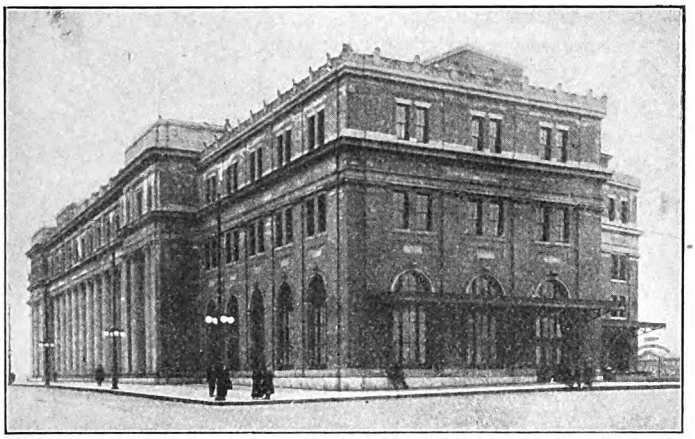
New Vancouver Terminal: Canadian Pacific Railway.



GENERAL VIEW OF C.P.R. TERMINAL BUILDINGS, VANCOUVER, B.C.

IN order to meet increasing traffic demands at Vancouver, the western terminus of the Canadian Pacific Railway, it was decided about three years ago to provide increased facilities for dealing with passenger and freight traffic. This traffic is not merely that due to the trans-continental and local work of the railway, but also includes that due to the steamship services between Vancouver and the various Pacific Coast ports, and to and from ports in Japan, China, Australia, and the Philippines, in addition to interchange traffic with other steamship lines at Vancouver. In construction, therefore, complicated requirements had to be met, and the character of much of this traffic necessitated accommodation on somewhat special lines.

The work involved was completed, except that provision is made for subsequent developments on a still larger scale, and the new premises brought into use in July, 1914. It was carried out under the direction of Mr. J. G. Sullivan, Chief Engineer, Canadian Pacific Railway, and we are indebted to Mr. H. Rindal, Engineer in charge of the Vancouver Division, for particulars of the undertaking and the illustrations of the station reproduced.

The passenger station is at the foot of Granville Street, one of the principal thoroughfares in the city of Vancouver. This street has been extended over the passenger and freight tracks to a new steamship pier. At Burrard Street another viaduct has been constructed over the tracks to afford access to the steamship pier, built in 1908, and which has since been extended to provide for the larger steamships put into service more recently. The extension of Granville Street by a viaduct over the tracks gives access to the upper level of the new steamship pier. Baggage and freight are received at the pier on the lower level to which access is had by ramps leading from Granville Street and Burrard Street viaducts. The substructure of the pier is built largely of creosoted timber. A railway track, depressed to bring the floor of the cars about level with the pier floor, is carried through the middle of the pier.

In the station there are now four through tracks raised about 5 ft. above the old level, and there is room for additional passenger tracks to the north over the site now occupied by freight tracks. The station building facilities are adequate to serve many more tracks than are now involved. Two tracks are provided for inbound and two for outbound passenger trains with separate platforms. There is also a platform adjoining the station used for baggage, mail, and express only. Although Vancouver is the terminus of the line, the station is arranged as a through station, incoming trains proceeding westward and back through the adjoining freight yard.

The station is built on two levels, the main hall and public offices being on street level, with the platforms and platform offices below. Independent exits, electric baggage lifts, etc., are provided between platform and street levels. The passenger station is a steel frame structure with pressed brick exterior walls and Indiana limestone trim. The main facade of the building consists of a colonnade of ten free standing Ionic columns, 35 ft. high, flanked by pavilions or end

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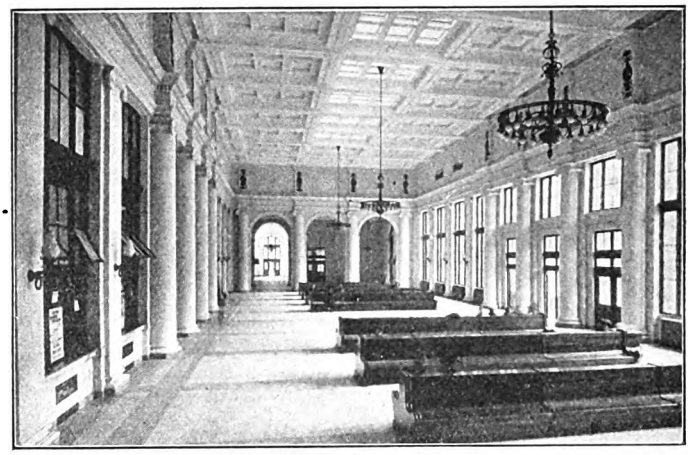


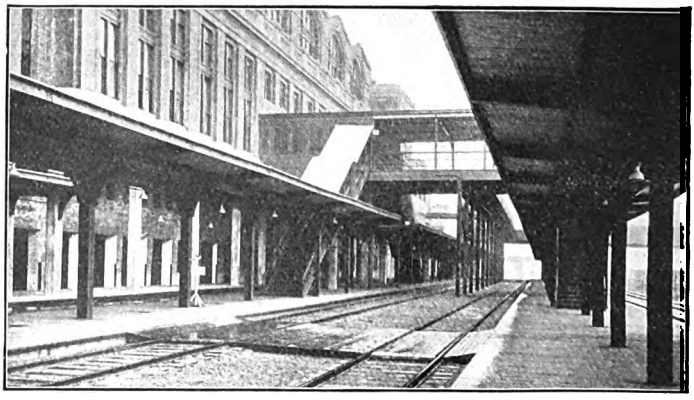
GENERAL WAITING HALL.

wings. The track facade of the building includes a series of large arched openings. Ionic pilasters and engaged columns, artificial Caen stone, are used for the decoration of the walls of the general waiting-room, with the walls tinted to match the stonework. The floors are of Terrazzo, figured with a design panelled to match the arrangement of seats and wall columns. The ceiling is 40 ft. above the floor and of heavy beam and panel design. Illumination is by means of incandescent electric lamps, the ornamental ceiling fixtures and wall torches of special design being of cast bronze. The seats in the main waiting-room and the woodwork around the ticket office are of oak. The smaller waiting-rooms, dining-room, etc., are treated in a very simple manner with oak wainscoting, plaster walls, and plain panel ceiling.

Above the ground floor are three floors devoted to offices for the use of the railway company. A large interior court affords natural lighting for the general waiting-room and also for the interior office rooms. Four passenger elevators serve the office quarters and the lower mezzanine and track level floors. Heating, ventilation, and lighting have received special attention, while there is also a complete fire protection system and an equipment for vacuum cleaning. On the main public floor are the general waiting-room, ticket offices, lunch-room, ladies' waiting-room, smoking-room, and baggage checking-room. The general waiting-room is 212 ft. by 56 ft., including the east and west lobbies, each of which measures 46 ft. by 28 ft. The ladies' waiting-room and the smoking-room are each 46 ft. by 36 ft. On this floor also is the lunch-room. The kitchen and refrigerating rooms are placed on a mezzanine floor below the street level.

On the track floor are the baggage, mail, and express-rooms, and accommodation for Canadian and United States Customs, etc. Between the station building and Cordova Street at the lower level is a large paved area used for baggage, mail and express vans. Access to this area from Cordova Street is had by a ramp descending by easy grades to the west of the station building.

On the pier is a waiting-room, 83 ft. by 96 ft., ladies' waiting-rooms, smoking-room, and accommodation for the immigration and Customs departments of Canada and the United States. A promenade overlooks the harbour and is reached from the waiting-room. The ticket office, parcel-room, and baggage checking-room are conveniently reached on the concourse leading to the main waiting-room.



VIEW AT PLATFORM LEVEL.

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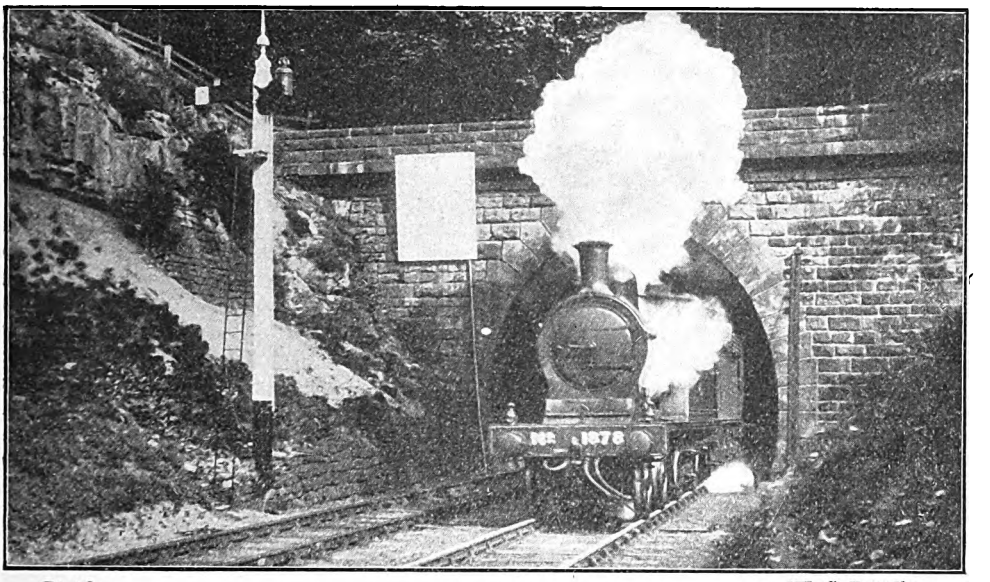

Photo] [*W. G F. Kelly.*

NORTH EASTERN RAILWAY.
Leeds-West Hartlepool Express leaving Crimple Tunnel.
4–4–0 locomotive No. 1878 (Class Q).

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

AS we can fairly claim, I think, to have discussed in all their bearings the contentious questions of train delays, with their causes and effects upon locomotive running, I wish to return to the serial discussions on the dimensions and proportions of modern superheater express locomotives, of which the last appeared in the November issue of 1914. Up to the present we have dealt with cylinder dimensions, heating surface, grate area, working pressure and driving wheel diameter; we now come, therefore, to the subject of adhesion weight.

The correct proportion that the adhesion weight of a locomotive should bear to its total weight is a vexed question, as obviously it directly governs the wheel arrangement. Columns of the technical and non-technical railway press have been filled—largely by the pens of zealous supporters of one or other railway company's locomotive practice—as to the merits or the demerits of adequate adhesive weight, until one has been almost led to suppose that adhesion was some new form of motive power. I must confess that I have been guilty in the past of entering into the lists myself. Let us briefly examine the various contentions, and state some elementary facts. Increasing traffic demands in the matter of load and speed over any given route call for increased cylinder power, and increased cylinder power theoretically demands correspondingly increased adhesive weight in order that it may be transmitted to the rails. But weight limitations which are imposed on locomotive designers on account of the strength of the track and the underline bridgework do not permit of the load on the driving axle being increased indefinitely, and this fact has led to the coupling of axles, in order that the adhesion weight may keep pace with the development of cylinder and boiler dimensions. So, in express locomotive work, the early "single-driver" has given place successively to the four-coupled and six-coupled engine, and the four-coupled locomotive in goods and mineral service to the six-coupled, eight-coupled and even

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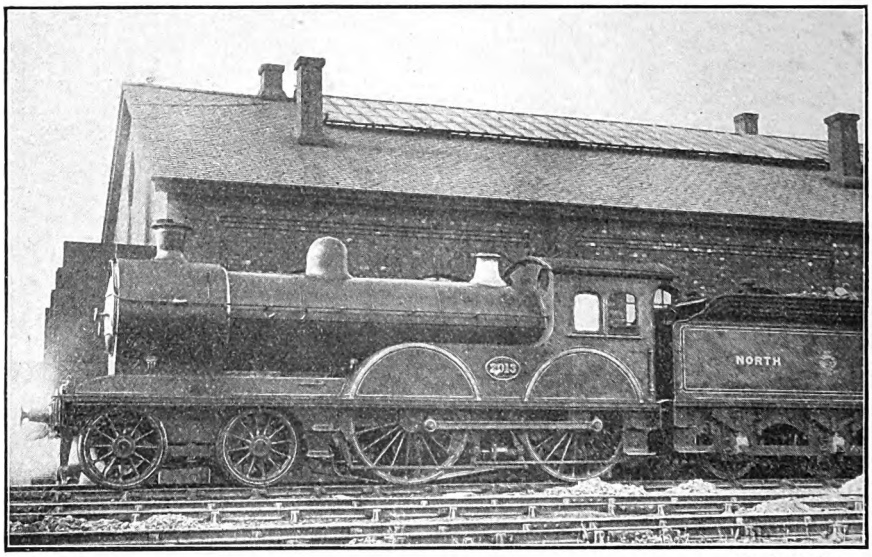
ten-coupled engine in foreign countries. In this country express locomotive practice has developed on two divergent lines, the one-time standard four-coupled express engine having grown on some lines into the 4–4–2, or "Atlantic" type, and on others to the 4–6–0 type, and it is as to the relative merits of these two wheel arrangements that controversy has raged to the fiercest degree.

The advantages offered the "Atlantic" wheel arrangement are important. The provision of a trailing carrying axle behind the driving wheels allows of the development of that most important part of an engine's anatomy—the firebox—which may be spread across the frames, instead of fitted between them. It is curious, however, that only two of the English lines using "Atlantics"—the Great Northern Railway and the London, Brighton and South Coast Railway—have availed themselves of this essential constructional advantage. For the same reason the 4–6–2 wheel arrangement finds much favour on the Continent and in America, although, strangely enough, we can only boast one solitary example of the species in this country. In the second place the proportion of tractive power lost in overcoming internal friction at high speeds is obviously likely to be less with a four-coupled than with a six-coupled engine. On the other hand the adhesion weight of a four-coupled engine is limited to a maximum of from 40 to 42 tons—and substantially less than this on some lines—so that the "Atlantic" is really no more than equivalent to a 4–4–0 with a more ample capacity for raising steam than could be arranged upon eight wheels. This is evident from a glance at a table to be given in the next number, in which the average adhesion weight of superheater "Atlantics" will be seen to work out at 37·8 tons, or almost identical with the 37·3 tons of the 4–4–0 engines; the former figure amounts to 53 per cent. of the average total weight of the engines concerned, and the latter to nearly 66 per cent. The enlarged firebox of the "Atlantic" certainly affords a better means of thoroughly consuming the coal, and the increased length of the boiler obtains the maximum calorific value from the fuel, but at an increased initial constructional cost.



Photo] [*P. F. Cooke.*

NORTH EASTERN RAILWAY.

No. 2013 at Bridlington. The engine is shown as fitted with superheater and extended smokebox.

The coupling of three axles instead of two, however, affords an increase in the weight of the engine available for adhesion of some half as much again. In actual practice the increase does not work out to fully 50 per cent., seeing that such a concentration of weight on so short a length of track as corresponds to the driving wheel-base is not always permissible. Of the engines shown in the same table, only the

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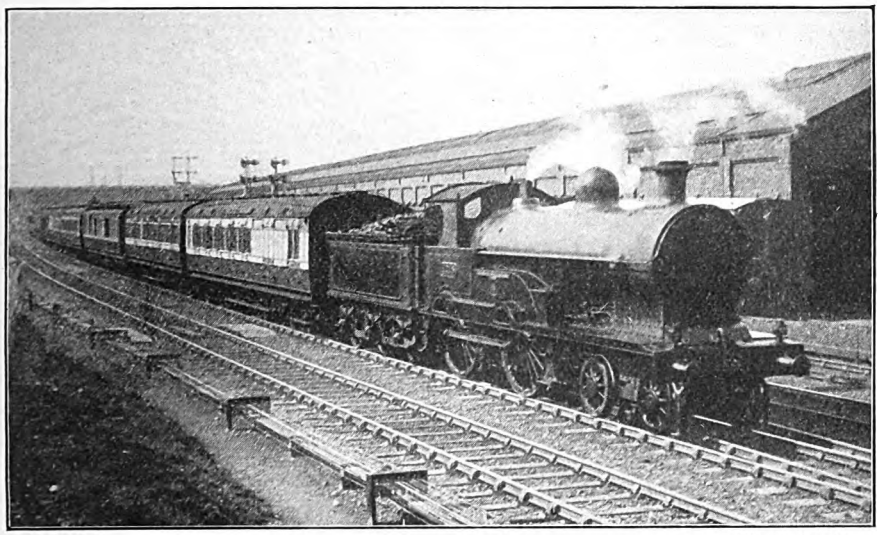
4–6–2 Great Western engine, *The Great Bear*, has as much as 60 tons resting on the driving wheels, although closely followed by the London and North Western 4–6–0, *Sir Gilbert Claughton*, with 59 tons, and Mr. Urie's 4–6–0 on the London and South Western Railway, with 58·6 tons; the 4–6–0 express engines as a whole average 52·1 tons adhesion weight apiece, or 40 per cent. more than the 4–4–0 engines, and 38 per cent. more than the "Atlantics." Now this does not claim for six-coupled engines any absolute immunity from slipping. It is quite possible to find an isolated 4–6–0 engine in such a condition that it is given to slipping more than a 4–4–0 or an "Atlantic." There is probably not a locomotive type extant in this country of which the wheels could not be made to slip on a dry rail under certain conditions. This is because the actual adhesion between wheel and rail is dependent on many factors other than that of nominal adhesion weight. For example, the use of sand radically alters the co-efficient of friction between the wheel and the rail, and steam sanding has revolutionised the adhesion problem. Again, the cylinder dimensions of a locomotive are not designed in any fixed relation to adhesion weight—as we shall see in a table of these proportions that I hope to give in the next issue—with the result that an "over-cylindered" 4–6–0 may easily be more prone to slipping than an "under-cylindered" four-coupled engine.

Putting these considerations aside, however, there are certain logical conclusions which cannot be avoided. Assuming two engines of the same cylinder and steam-raising capacity, and of equally satisfactory design, the 4–6–0 with the 40 per cent. advantage in adhesion is surely bound to prove the more reliable with heavy loads, over heavily-graded lines, or in districts where severe weather conditions prevail. On the other hand, the 4–4–2 might be expected to show the greater economy with lighter loads on high speed train services, or over a level track—that is, where the running conditions are not of the most severe character. Obviously so many factors may influence the performance of a locomotive that these are not by any means infallible arguments, but they are borne out by a brief consideration of the modern tendencies of locomotive design. Were the easier conditions of express train running just cited more prevalent in this country than they are, there is little doubt that the "Atlantic" type of engine would have found more favour than it has done. The work of the Great Northern "Atlantics" on the Leeds expresses—moderate in weight but fast in timing—is particularly praiseworthy,



Photo] [*F. W. Curtis.*

LONDON AND NORTH WESTERN RAILWAY.
Irish Boat Express, passing Willesden Junction.
4-4-0 locomotive No. 1218, *Australia.*

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while the North Eastern "Atlantics" do equally well with all ranges of load on the level stretch between York and Darlington. But the former of these types would very likely show to but doubtful advantage, for example, on the Great Eastern Railway—a line on which difficulties of load and gradient could hardly be exaggerated, and where the use of six-coupled in place of four-coupled engines has revolutionised the locomotive performance. As to the North Eastern Railway "Atlantics," the weight of 40 tons on two axles would prohibit their use on the Great Eastern Railway at all, owing to permanent way restrictions. Most of the important lines of the country have to legislate for both sets of running conditions, on account of the difficulty of reserving one type of express locomotive for particular train services, and as a consequence the 4–6–0 wheel arrangement has made rapid strides in recent years.

The East Coast Railways are the principal supporters of the "Atlantic" type. No one would, of course, seek to advance the opinion that the demands made on locomotive power on the Great Northern, North Eastern and North British Railways are in any marked degree inferior to those elsewhere, as in the case of the heavy Anglo-Scottish trains the combined effect of heavy loads and long adverse grades involves particularly arduous locomotive work. But on these lines the locomotive departments concerned, more especially of the two southern partners, appear to have evolved standard "Atlantic" designs that give satisfaction, with the result that they have now become permanently prejudiced in favour of the 4–4–2 wheel arrangement. The case of the North Eastern Railway is the more curious in that fifteen 4–6–0 engines—ten with 6 ft. 1¼ in. and five with 6 ft. 8¼ in. wheels—were built in 1900 and used for some time with apparent success on express passenger service, but since the introduction of "Atlantic" locomotives in 1903 the fast passenger work has been mainly given over to 4–4–0 and 4–4–2 engines. Of the latter type there are now 62 on the North Eastern Railway—10 of the initial class V, which could not be termed the most satisfactory of engines, 10 of the second batch having the same class letter, which with 19½ in. in place of 20 in. cylinders have done much better work, and 40 of the very successful three-cylinder superheater class Z, to which now all the more important duties are entrusted. There are also the two four-cylinder compound "Atlantics," now superheated, and enjoying the best of reputations. The Great Northern

NORTH EASTERN RAILWAY. DARLINGTON–YORK.

Distance (miles).	Engine No. / Type and class / Driver / Load (axles) / Load (tons)		1672 4-4-0 R Watson 24 165		1207 4-4-0 R† 20 135		2195 4-4-2 Z† Young 23 145		Schedule (mins.).
—	Darlington	dep.	0.00	*	0.00	*	0.00	*	0
2·6	Croft Spa	pass	3.54	67.1	4.30	59.2	4.30	57.7	—
5·2	Eryholme	,,	6.14	69.2	7.10	60.0	7.15	57.7	—
10·4	Danby Wiske	,,	10.33	—	11.35	76.3	12.00 b	70.3	—
14·2	Northallerton	,,	13.46	—	14.45	71.4	16.15	—	14
21·9	Thirsk	,,	20.04	78.2	21.05	77.5	23.35	73.8	21½
28·0	Pilmoor	,,	25.09	—	26.10	73.8	28.35	75.0	—
32·9	Alne	,,	29.09	76.2	30.05	77.5	32.25	78.9	32
38·6	Beningbrough	,,	33.45	—	34.30 a	80.3	36.50	78.9	—
42·5	Poppleton Jc.	,,	37.00	—	40.00	—	40.00 c	—	40
44·2	York (S. End)	arr.	39.34	—	42.50	—	42.50	—	43
44·2	Net times		39 min. 34 sec.		40 min. 15 sec.		40 min. 30 sec.		43
16·7	Thirsk-Beningbrough		13 min. 41 sec.		13 min. 25 sec.		13 min. 15 sec.		—
	Average speed		73·2 m.p.h.		74·7 m.p.h.		75·6 m.p.h.		—

† Superheater engine. * Maximum and minimum speeds (chronograph readings) in miles per hour. a—Very severe permanent way check, Skelton Bridge. b—Permanent way check, Wiske Moor, severe. c—Signals outside York, slight.

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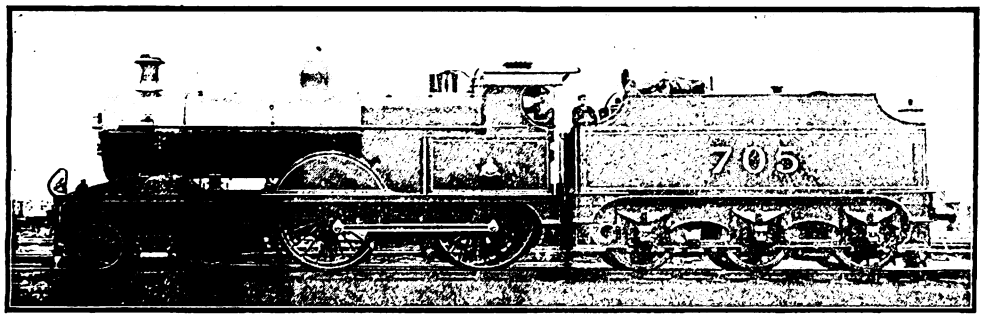
owns altogether 115 "Atlantics"—91 of the large-boilered type, and 21 of the small, together with 3 compound locomotives, while the North British stud numbers 20 engines. Between them, therefore, the East Coast Companies account for 197 out of the total of 283 "Atlantics" now at work in this country.

As regards the other "Atlantic" users, however, construction at the present time seems to be in a transition stage. The Lancashire and Yorkshire Railway, which followed the lead of the Great Northern Railway in 1899 and produced a useful 4–4–2 batch of 40 engines, has not built any more locomotives having this wheel arrangement, but has instead turned out 20 powerful 4-cylinder 4–6–0 engines. Although one of the most successful "Atlantic" users, with 31 of this type now in service, the Great Central Railway has not constructed any engines of this wheel arrangement in recent years, but has subsequently built 5 powerful 4–6–0 locomotives, as well as a series of enlarged 4–4–0 engines which now take turns with the "Atlantics" on the heaviest duties, and have already a splendid reputation. It will not, perhaps, be revealing a State secret to say that the "Director" class of Great Central Railway 4–4–0 engines are doing the work of the "Atlantics" on a lower coal consumption than that of the latter engines. Obviously wheel arrangement and the proportion of adhesive to total weight bear no part in this result, for which superheating and modern improvements in design are, of course, responsible. But it is interesting to note how the strengthening of the permanent way on this and other lines now permits of the use of heavier axle-loads, for probably to this more than any other cause we owe the revival on many railways of the 4–4–0 wheel arrangement, with greatly increased dimensions. On the Great Western Railway the whole of the 4–4–2 locomotives at one time in use have actually been converted to the 4–6–0 wheel arrangement, with the sole exception of the three French compounds. The London, Brighton and South Coast Railway—the only other "Atlantic" user—has not added to its stock of 11 engines since 1911, but has subsequently constructed some very powerful six-coupled express tank locomotives of the 4–6–2 and 4–6–4 wheel arrangements. There is, therefore, a total of 283 "Atlantic" express engines now in service in Great Britain.

It must be admitted that the 4–6–0 type is in a stronger position. The Great Western and London and North Western Railways are the largest users, the former having 77 two-cylinder and 71 four-cylinder engines in express passenger service—total 148—and the latter 105 two-cylinder engines of the "Experiment" class, 40 of the corresponding superheater "Prince of Wales" class, and 20 of the four-cylinder superheater "Claughton" class—total 165. So far as passenger service is concerned, the London and South Western Railway is probably the next largest user, having now 36 engines at work—10 of the original 6 ft. Drummond types, 15 of the Drummond 6 ft. 7 in. type, all four-cylinder, and 11 of the new Urie two-cylinder 6 ft. superheater engines, of which one has been converted from a four-cylinder engine. After this comes the Great Eastern Railway—the latest convert and perhaps the most rapid builder of all—which has now 34 4–6–0 engines in service. Beyond these lines the Great Central Railway employs 17 6 ft. 6 in. and 6 ft. 9 in. 4–6–0 locomotives largely on passenger



Photo] [*P. F. Cooke.*

MIDLAND RAILWAY.

No. 705, rebuilt with superheater and extended smokebox.

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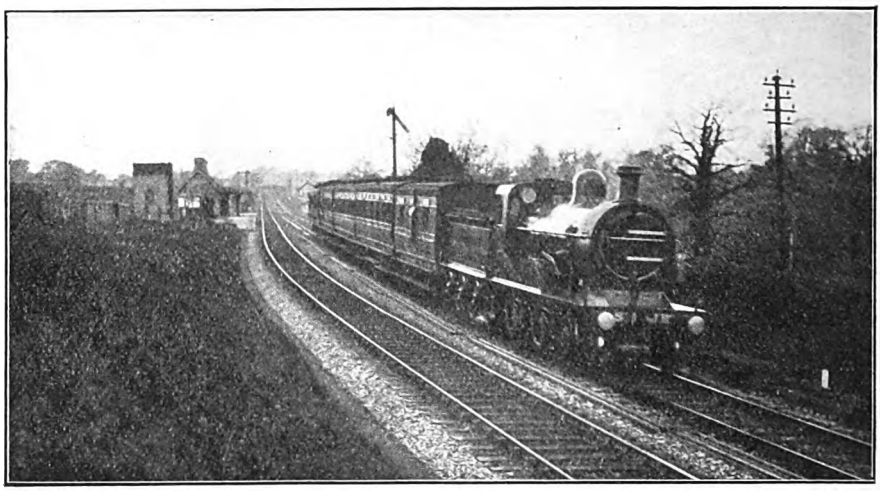
work—5 of the "Sir Sam Fay" type, and 12 of earlier classes—while the Lancashire and Yorkshire Railway uses 20 four-cylinder engines of the 4–6–0 type. In Scotland the Caledonian Railway owns 42 examples of this wheel arrangement, of which, however, only 7 have 6 ft. 6 in. wheels, and are intended for express passenger service; the Glasgow and South Western Railway has 19 4–6–0 express engines, and the Highland Railway 31. Finally, the 4–6–0 users will shortly be joined by the Great Southern and Western Railway, which has a series of 5 four-cylinder engines of a new type in hand. The passenger 4–6–0 engines in present use in Great Britain therefore total 477 in number, while to these the large number of small-wheeled mixed traffic engines of this wheel arrangement used on the London and North Western, North Eastern, Great Central, Caledonian and Great Southern and Western Railways must be added to make up the grand total of 807 4–6–0 locomotives.

Perhaps the most interesting commentary on the situation is that 69 new 4–6–0 engines were put in service in 1914, practically the whole of which were intended primarily for express passenger and not for mixed traffic working, while the 4–4–2 type only increased by 13. The latter engines were built by one railway only—the North Eastern—and it is significant of the trend of modern express locomotive design that, with the North Eastern Railway alone excepted, no "Atlantic" engines have been built in this country for four years past. At the same time 47 new 4–4–0 engines were added to the locomotive stock of the country during 1914, of which 41 were of modern large-boilered superheater types, and, curiously enough, these latter were divided between four lines—the Caledonian, North British, South Eastern and Chatham, and Great Northern (Ireland)—whose largest standard express locomotives are respectively of the 4–6–0, 4–4–2 and in the last two cases 4–4–0 wheel arrangements. Presumably the position is somewhat as follows: locomotive superintendents find that, by the use of modern constructional improvements, and in view of the higher axle-loads permitted by present-day permanent way, they can design a boiler of increased diameter for an eight-wheeled engine equal in steaming capacity and fuel economy to that previously erected on an "Atlantic" wheelbase. Thus in such cases the extra axle and the enhanced constructional cost of a ten-wheeled over an eight-wheeled engine offer no compensating advantages in the matter of adhesion, steam-raising powers, or running economy. Or, alternatively, a boiler of still increased dimensions is placed upon six axles, of which three are coupled, and the additional adhesion thus obtained enables increased cylinder capacity to be incorporated in the design, for dealing with the



Photo] [*L. Belloc.*

SOMERSET AND DORSET JOINT RAILWAY.

Bournemouth-Bath train passing Chilcompton at 50 miles per hour.

4–4–0 locomotive No. 77.

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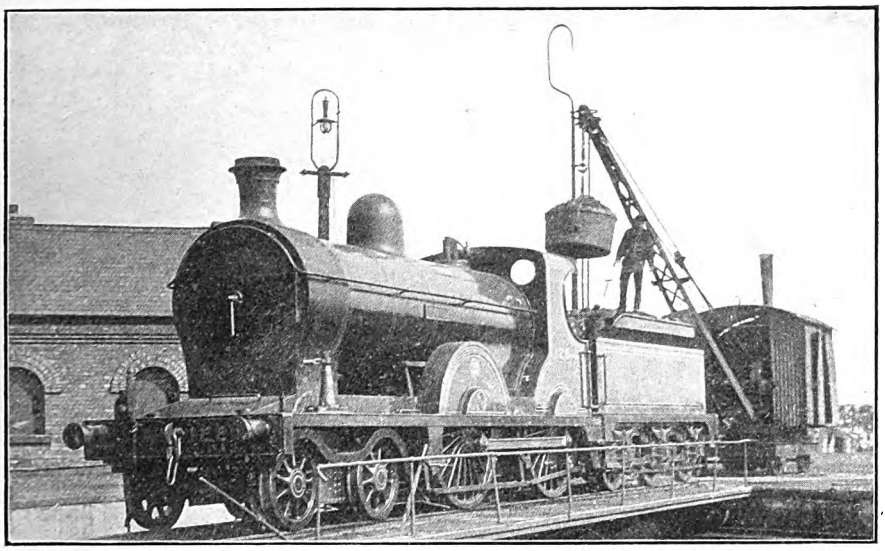
heavier classes of work. This may explain the present popularity of large 4–4–0 and 4–6–0 superheater engines on all the leading British railways save two, and we shall not probably see any change from this line of development until the "Pacific" or 4–6–2 wheel arrangement is seriously introduced.

The fallacy that the coupling of six wheels has any adverse effect on speed has, of course, long since been exploded. It has rather interested me recently to look into all my highest speed records, and to notice what were the various types of engine concerned. The maximum speed I have ever timed is 90 miles per hour, and I have recorded this on five occasions—twice with a 4–6–0, twice with a 4–4–2 and once with a 4–4–0! Of the two 4–6–0 maxima, one was secured with a two-cylinder Great Western 4–6–0 engine for a continuous $1\frac{1}{4}$ miles on the Gerrard's Cross bank of $6\frac{1}{2}$ miles at 1 in 175–264. The other was behind a London and North Western "Experiment," piloted by a 2–4–0 "Jumbo" on the descent of "Shap" incline; on a 1 in 75 grade, of course, the attainment even of 90 miles per hour is not a difficult feat, but the occasions are rare on which drivers let their engines go on such inclines to this extent. The 4–4–0 record was secured on the Midland Railway behind a Johnson 4–4–0 of Class 3 on the 1 in 100 descent from Blea Moor tunnel to Settle, and the same remark applies. The "Atlantic" maxima, however, were recorded on 1 in 200 and 1 in 176 grades respectively, the first being timed on the long Great Northern incline from Stoke to beyond Essendine, and the second on the Great Central descent from Ashby Magna to Leicester. A maximum of 88·2 miles per hour is one I have not recorded, but of 86·5 and 84·9 miles per hour I have a number of examples. On the Great Western Railway I have timed 84·9 behind the French compound, *La France*, and also a "County" 4–4–0, on the Gerrard's Cross bank, and 86·5 behind both two-cylinder and four-cylinder 4–6–0's on the long 1 in 290–264–200 descent north of Princes Risborough. On the Midland Railway a rebuilt 4–4–0 has given me 86·5 in descending from Blea Moor, while a Deeley "999" once touched the same figure on the 1 in 200 from Ampthill to Bedford. I have also recorded 84·9 and 86·5 a number of times on the Great Northern Essendine bank behind large and small "Atlantics," on the Great Central Ashby bank behind an "Atlantic," on the London and North Western Railway north of Shap (a 1 in 125 descent) behind an "Experiment," and on the London and South Western Railway behind a small 4–4–0 in the descent from Honiton to Exeter. One of my most unusual 84·9 records was behind a small 4–2–2 engine of Class J, North Eastern



Photo] [*J. Macartney Robbins.*

GREAT NORTHERN RAILWAY (IRELAND).

4–4–0 locomotive No. 128 *Mars*, taking coal.

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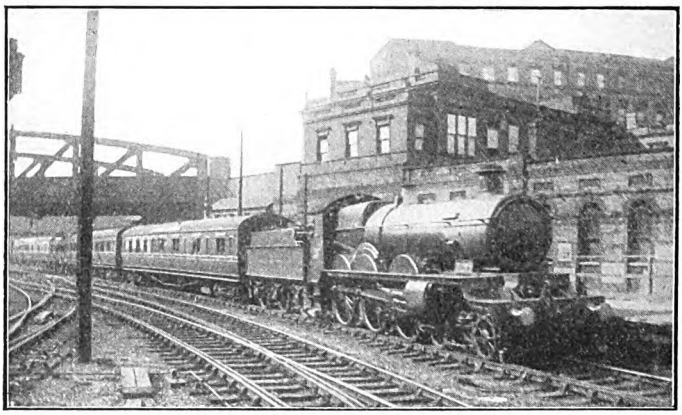
Railway, in the descent of Church Fenton bank. From this it will be apparent that the coupling of wheels does not affect speed performance, seeing that 4–6–0, 4–4–2, 4–4–0 and 4–2–2 engines are all represented in these records.

More remarkable than these figures, however, are the extraordinary speeds obtained and maintained by modern locomotives on a level track. My highest record of this character is held by the North Eastern 4–4–0 superheater engine 1207, of class R, which two years ago covered 4 continuous miles near Beningbrough, on a dead level road, at 80·3 miles per hour. The load was light—only 23 axles, or 145 tons, to be exact. More recently No. 2195, a new North Eastern three-cylinder superheater 4–4–2, with the same load, very closely approached this figure, maintaining 78·9 miles per hour, and covering 13⅛ miles on the level or a grade not falling at more than 1 in 805, in 10 min. 10 sec., at an average of 77·4 miles per hour. Another really exceptional effort was that of a North Eastern class J "single-driver" (4–2–2) which last summer attained a speed of 77·5 miles per hour on a dead level track between Malton and Scarborough. Previously my highest speed, at this point had been 76·3, with an engine of the same class, but the loads in each case were only the mere featherweight of 80 tons. Both the two last-mentioned runs will be described presently. My other principal experiences of this character have been on the Great Western and London and North Western Railways, with much more substantial trains. On the former line a two-cylinder 4–6–0 with 270 tons maintained 77·5 miles per hour from Steventon to near Didcot, 3½ miles on a grade of 1 in 754. With the same engine and 240 tons 75 miles per hour was sustained for 6 miles east of Slough either on the dead level or on fractionally adverse grade of 1 in 1320. Another engine of the same type achieved the same feat with 270 tons behind the tender. On the London and North Western Railway with a two-cylinder 4–6–0 "Prince of Wales" type engine I have recorded a sustained speed of 75 miles per hour on a grade of 1 in 505, just north of Stafford, and one of 77·5 with the same train of 215 tons on the 1 in 330 between Tring and Watford. Curiously enough, the 4–2–2, 4–4–0, 4–4–2 and 4–6–0 wheel arrangements are again all concerned in these records, which speak eloquently of the improvements in design of the modern locomotive, and especially of the reduction of cylinder back-pressure and the gradual elimination of internal resistance. But we must now hasten on to performance—not that my remarks on the question of adhesion are by any means yet concluded!—or there will be no space left.



Photo] [*A. C. Johnstone.*

GREAT WESTERN RAILWAY.

Plymouth express running into Paddington station.
4–6–0 locomotive No. 4021, *King Edward.*

I wish first to describe the run on the North Eastern Railway mentioned in the last paragraph, on the 1.9 p.m. 43-min. express from Darlington to York. As this is of particular interest in that it is the first "log" on this train behind an "Atlantic" of class Z that has appeared in the public

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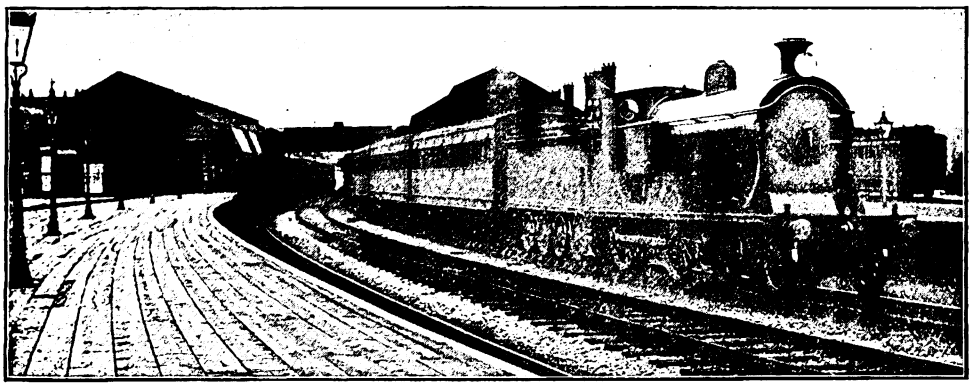
press, I have tabulated it together with my previous record behind the 4–4–0 superheater No. 1207 (class R), and also the historic fastest recorded run ever made on this train behind the non-superheater R class engine 1672. Very little need be said about the last-mentioned run, which has more than once been described in these columns. Its principal feature was the simply phenomenal start, the engine accelerating to 69·1 miles per hour on just over 2½ miles of level track, and *further* to 69·2 up a similar distance at 1 in 356–377! The speed at Thirsk was also exceptionally high, but beyond Alne the gait was more in accordance with the normal. With quite a respectable load this was, of course, an astonishing effort for a 4–4–0 non-superheater engine built as far back as 1900. On the second run the train was on time from the start, and the engine was not pushed out to Eryholme. From Danby Wiske on to Alne, however, the times showed a slight improvement of 6 sec. on those of the "record of records," and a tremendous spurt followed, the speed rising just before Beningbrough and keeping for a mile or two beyond at 80·3 miles per hour. A bad permanent way check hampered the conclusion of the run, which might otherwise have been made in 40¼ min. On my recent trip behind No. 2195 the start was again inclined to be leisurely, and the engine did not pick up so well beyond Eryholme until after we had experienced the Wiske Moor check. But from Thirsk onwards all records for sustained speed on this length went by the board, the *average* for the ensuing 16·7 miles to Beningbrough being 75·6 miles per hour. We did not quite touch the 80 level in the matter of maximum speed, but the rate scarcely varied, a fraction from 78·9 miles per hour (¼-mile in 11⅖ sec.) all the way from Alne to Beningbrough. Although I rode in the next coach to the engine on this journey, except on starting or accelerating from the slack, not a sound from exhaust or motion was audible at the highest speeds.

I have also secured recently some excellent records of the work of this latest batch of North Eastern "Atlantics" on other trains. For example, No. 2196 did splendidly a day or two ago on the 1.20 p.m. (1.22 working time) from Darlington to York, allowed 49 min. for the run. Although the train totalled 41 axles, and weighed in all 255 tons, the start was exceedingly brisk, Croft being passed in 4 min. 40 sec. (a time only 10 sec. inferior to those of my two runs in the 1.9 p.m. table), and Eryholme in 7 min. 25 sec. The speed fell from 58·5 to 56·3 miles per hour on the short ascent. Shortly after passing Cowton, however, we experienced a bad permanent way check, and so took 18½ min. to get through Northallerton. But fine running with this substantial load followed: speed rose to 71·4 miles per hour at Thirsk, and after a brief lapse to 68·1 at Pilmoor, to a sustained 69·2 from Raskelf to Alne, after which the engine was eased, as the train was before time. The time from Northallerton to Thirsk was 7 min. 5 sec., from Thirsk to Pilmoor 5¼ min., from Pilmoor to Alne 4 min. 25 sec., and from Alne to Poppleton Junction, under very easy steam, exactly 9 min. In this



Photo] [*G. E. Ellis.*

LONDON AND SOUTH WESTERN RAILWAY.
Exeter train at North Road, Plymouth.
4–4–0 locomotive No. 401 (6 ft. class).

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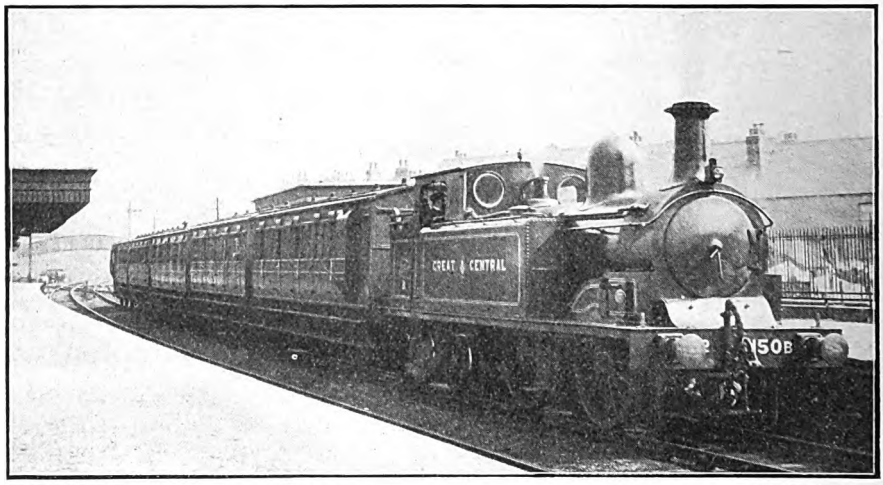
way the 28·3 miles from Northallerton to Poppleton Junction were covered in 25¾ min. instead of the 29 min. allowed. Signals were on just outside the north end of York station, where we came to a stand, almost exactly 44 miles from Darlington, in 47 min. 5 sec. from the start, or about 44½ min. net. In the opposite direction another engine of the same type, of which I omitted to note the number, worked a train of 46 axles, or 300 tons in all from York to Thirsk in 25 min. 50 sec., which with so heavy a load was very smart work for this 22¼ miles' journey. Beningbrough, 5·6 miles, was passed in 9 min. 10 sec., and from there until steam was shut off a speed of from 61·6 to 64·3 miles per hour was maintained against the very gradually rising tendency of the road. A time of 12¼ min. for the 12½ miles from Beningbrough to Sessay was a particularly good one with 46 axles in this direction of running.

On the Leeds, Harrogate and Stockton section, also, I have timed some unusually fast running. The 4.30 p.m. express *ex*-Leeds, through from Liverpool to Newcastle, takes the Wetherby route between Leeds and Harrogate, the reason which is difficult to understand in view of the 4¼ miles' increased distance and the truly fearsome gradients of the Wetherby line. For the 22½ miles an allowance of 40 min. is made, and rarely improved on, even with the modern locomotive stock. But No. 2199 gave me a pair of really excellent runs over this stretch recently. On the first the load was as much as 43 axles, or 260 tons. The initial 8·8 miles to Thorner took 17¼ min.; they are almost entirely adverse, commencing at 1 in 300 and 160 to Cross Gates, and continuing thence for some miles at 1 in 70. From Thorner to Wetherby is 5·8 miles, and includes the severe slack for Bardsey curve; this distance took 7 min. 40 sec. The final 7·9 miles into Harrogate, of which the concluding 5 miles are a practically unbroken climb at 1 in 85 to 95, took 12 min. 55 sec., making the total time from Leeds 37 min. 50 sec. An economy of 2 min. 10 sec. on schedule was excellent with the rather unusual load of 43 axles. Still better work was done by the same engine a few days later with 32 axles, or 200 tons only. Crossgates, 4·4 miles, was passed in 8 min., and on the 1 in 70 beyond the speed did not fall below 28·7 miles per hour. Thorner, 8·8 miles, was passed in 15 min. and Wetherby, 14·6 miles, in 22½ min. Before Spofforth a rate of 55·6 miles per hour was attained, and we then went up the 1 in 85 beyond without the speed falling below 31·7 miles per hour. Consequently we reached Harrogate 35 min. 35 sec. after leaving Leeds, this economy of 4½ min. on schedule being, in my experience, quite unprecedented.

In a recent number details were given of a good run on the same train between



Photo] [*P. F. Cook.*

GREAT CENTRAL RAILWAY.

0-4-4 tank engine, No. 1150B, and train in Bolsover station.

This engine was formerly owned by the Lancashire, Derbyshire and East Coast Railway.

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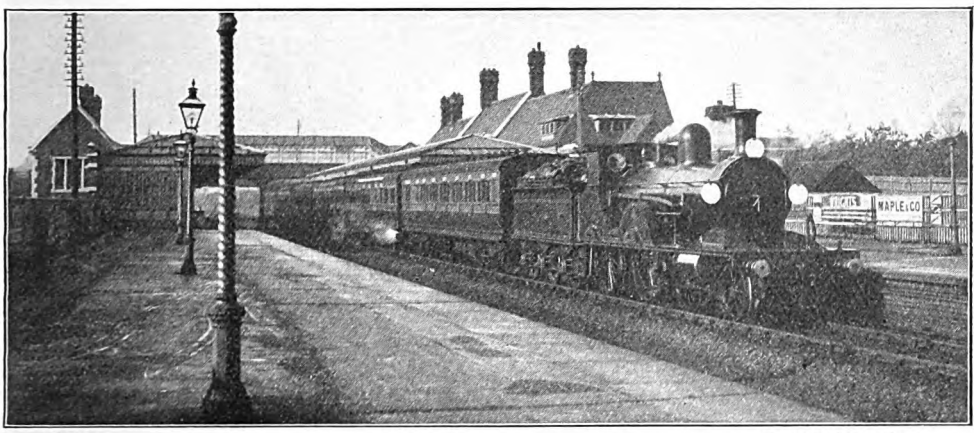
Harrogate and Stockton, but this I have recently bettered on two occasions. On the first the engine was No. 709 of the earlier three-cylinder "Atlantic" batch; the load was 36 axles, or 230 tons. The start from Harrogate, as previously mentioned, is exceptionally favourable, 2 falling miles at 1 in 66 to Bilton Junction being later succeeded by 4 at 1 in 131 to Ripon. On the latter incline we touched 71·4 miles per hour, and Ripon, 11·5 miles, was passed in 12 min. 50 sec. A good speed was maintained on the slightly rising stretch on to Northallerton, this 13·8 miles taking 14 min. 40 sec., while from Northallerton up to Welbury—entirely rising at 1 in 280 to 355—the 5·9 miles took 7 min. 20 sec. The remainder of the journey was taken very cautiously, and included a slack at Picton, a descent without steam to Yarm, and the usual bad check at Eaglescliffe Junction. Thus the 8·8 miles from Welbury to Eaglescliffe took 9 min. 40 sec., and the final 3 miles into Stockton 5 min. 5 sec. But we had completed the 43 miles' journey in 49 min. 35 sec., or nearly 6½ min. under schedule time. I secured a still finer record shortly afterwards behind No. 1243, one of the large-boilered R 1 class engines that has recently been superheater-equipped. Nidd Bridge, 3·4 miles from the start, was passed in exactly 5 min., and although the speed did not exceed 68·1 miles an hour down to Ripon, the latter town was passed in 12¾ min. On to Northallerton the speed was even better than before, the time from Ripon being only 13 min. 55 sec., and the maximum rate 64·3 miles per hour. So the initial 25·3 miles had been covered in 26 min. 40 sec. The lowest rate on the ascent to Welbury was 47 miles per hour, the time from Northallerton to Welbury being only 7¼ min., while Picton, 35·4 miles from Harrogate, was passed in the unusually fast time of 38¼ min. But as we were now well in front of time, it was a matter of no surprise that we ran into signals, which were "on" throughout from Yarm to Stockton. Thus our total time for the 43 miles' journey was 53 min. 10 sec.—even then nearly 3 min. under the unduly easy schedule!—but the net time of 48 min. showed a gain of 8 min. to the engine, and gave evidence of most praiseworthy work.

Before leaving the North Eastern Railway, I have also to describe the run previously mentioned behind the small single-driver of class J (4–2–2 type) between York and Scarborough. This did not quite come up to the record of 1913, which was described in the December issue of that year, but for all that it was a very smart journey. The engine was No. 1522, and the load a modest one of three 8-wheelers, or 80 tons in all. The start from Leeds rises for 4¾ miles, first at 1 in 218, and then for some 3 miles at 1 in 160 to 168. But Cross Gates, 4·4 miles out, was passed at 52·3 miles per hour, in 6¾ min. from the start, and Micklefield, where we reduced speed, 9·7 miles, in 12 min. 10 sec., speed rising to 65·2 miles per hour on the intervening level stretch. Down Church Fenton bank we touched 75 miles per hour, but signals were on all the way from Church Fenton to York, so that it



Photo] [*H. C. Gurney Smith.*

LONDON AND SOUTH WESTERN RAILWAY.
Birkenhead-Bournemouth train at Boscombe.
Rebuilt Adams 4–4–0 locomotive No. 570.

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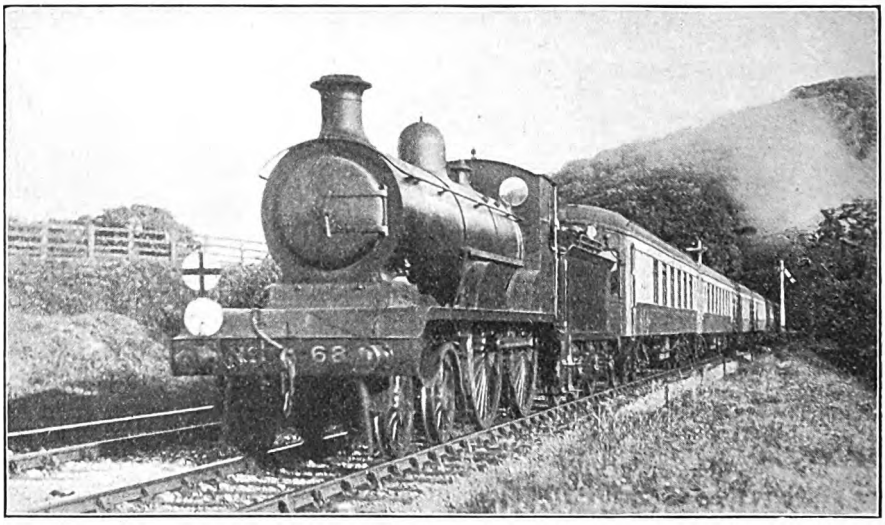
took us 30 min. 55 sec. to get through the latter station, 25·6 miles from Leeds. As well known, the curved nature of York station compels a funereal pace for quite half-a-mile. Accelerating again smartly, Haxby, 4·2 miles from York, was passed in a further 5 min. 35 sec., and on the comparatively level stretch beyond the pace rose to 70·3 miles per hour, not falling below 64·2 on the short in 300 rise to near Barton Hill. So the 7·3 miles from Haxby to Barton Hill were covered in 6½ min. In the neighbourhood of Kirkham Abbey are five miles of curved line adjacent to the river over which a restriction of 45 miles per hour is enforced; this was carefully observed, the 9·6 miles from Barton Hill to Malton, where also we slacked to 45, taking 11 min. 5 sec. Thence we did splendidly. On the faint rise to Rillington we accelerated to 68·2 miles per hour, while on the dead level stretch beyond we accelerated to 70·3 at Heslerton and no less than 77·5 miles per hour at Weaverthorpe. Thus the 4·4 miles from Malton to Rillington were covered in 4 min. 25 sec., and the 8·9 miles thence to Gauton in 7 min. 20 sec., at an average speed of 73 miles per hour. Fairly "hot" work this, I think, on a branch line! We were checked by signal at Seamer, and very slightly at Washbeck, so that the last 7·6 miles into Scarborough, took 9 min. 10 sec.; but with all delays we arrived dead on time to the second, having covered the 67·6 miles in exactly 75 min. The net time, however, was the excellent one of 71 min., even inclusive of the slacks at Micklefield, York, Castle Howard curves and Malton. This is, I fear, the last run on this train that will be obtainable for some time to come, as owing to war conditions it is not running this summer.

In conclusion, as the performance in the present article has turned out to be mainly "Atlantic" in character, I want to give the details of a further very remarkable run that I have actually enjoyed during the course of writing. As in the case of so many of the excellent Great Northern journeys described in the last issue, the engine was once again attached to Grantham shed, which would appear to boast the best time-keeping reputation of all the Great Northern locomotive depôts. The engine was No. 257—a small "Atlantic" which figured in one of the most noteworthy runs described last month—but the driver on this occasion was Hall. Similarly the train was the 2.20 p.m. *ex*-King's Cross, with a heavy load of 3 twelve-wheelers, 9 eight-wheelers and one six-wheeler, 57 axles, 382 tons empty, and 405 tons with a very full load of passengers and luggage. Down to Grantham No. 987 (also a small "Atlantic") appeared overloaded, although it must be confessed that a time of 90¼ min. from London to Peterborough, start-to-stop, and inclusive of the



Photo] [*T. B. Welch.*

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.

5.45 p.m. up "Southern Belle" emerging from Patcham Tunnel.

4-4-0 locomotive No. 68.

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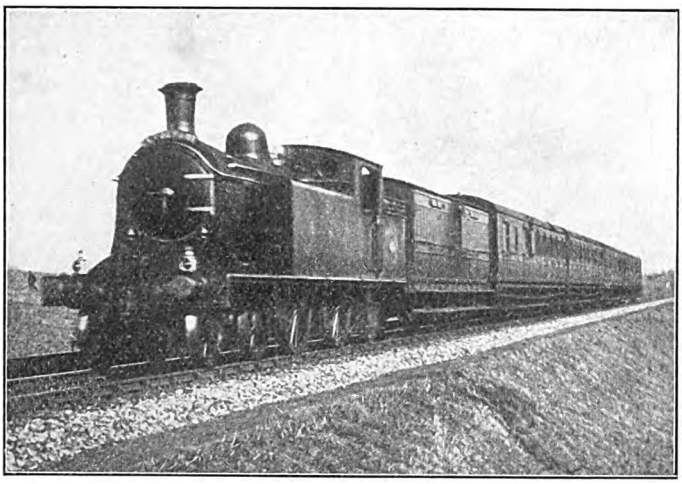
usual caution at Langely, was not by any means to be despised under these conditions. Indeed, 43 min. 55 sec. for the 44½ miles from Hitchin to Peterborough was quite a good time with a load of over 400 tons. The Peterborough stop was for water, owing to Werrington troughs being out of order, and we consequently arrived at Grantham 15 min. late. Here No. 257 was attached as before for the run to York. Most fortunately we had on this section a practically unchecked journey.



Photo] [*F. Bell.*

NORTH BRITISH RAILWAY.

1.40 p.m. Edinburgh-Clydebank train near Westcraigs.

4-4-2 tank engine No. 134.

With this tremendous train the start was not so brisk as before, but yet was very good, Hougham, 6 miles, being passed in 9 min. 40 sec., and Newark, 14·6 miles, in 17 min. 10 sec. A maximum speed of 69·2 miles per hour was reached between the two last-mentioned points, and so excellently was the rate sustained that the ensuing 6·3 level miles to Carlton were covered in 5 min. 50 sec. The initial distance of all but 21 miles to Carlton had, therefore, been covered in 23 min. Up Tuxford bank first-class work was performed, speed not falling below 46·4 miles per hour despite the 6¼ miles' ascent, of which over half is at a 1 in 200 inclination. So the 7 miles from Carlton up to Markham Box took 8½ min., and the 5·2 miles thence down to Retford 5 min. exactly. A time of 36½ min. to Retford is quite a "record" in my experience with such a load as this. From Retford to Ranskill we took 5 min. 25 sec. for the 5·4 miles, but a permanent way caution on Scrooby troughs, although not severe, hampered our ascent to Piper's Wood, and caused the 12 miles from Ranskill to Doncaster to take 13¾ min. Despite this check, however, we had done wonderfully well to pass Doncaster in 55 min. 40 sec. from Grantham (54¾ min. net, 50·5 miles) with 57 axles; the booked time is 58 min. From Doncaster the 10 miles on to Balne took 10 min. 55 sec., and the 8·4 miles thence to Selby 9 min. 40 sec.; the rate of approach to the latter station was much slower than the specified restriction, but I cannot say whether or not signals were against us. This slow passage of Selby made us lose time on the rising grades to Escrick, this length of 6·7 miles taking no less than 9¾ min.; the final 7·1 miles into York consumed 9 min. 5 sec. In all, therefore, our total time from Grantham to York, 82·7 miles, was 95 min. 5 sec.; allowing for Scrooby check it was 94 min. net, and allowing in addition for the slow running through Selby, 93 min. net. As the schedule time of this train is 97 min., such work under difficult conditions was most commendable, and reflected great credit on driver Hall. It serves to show that the "Atlantic" type of locomotive, under capable management, is by no means impotent where excessive loads are concerned, although from the standpoint of reliability under all running conditions its popularity may be on the wane at the present time.

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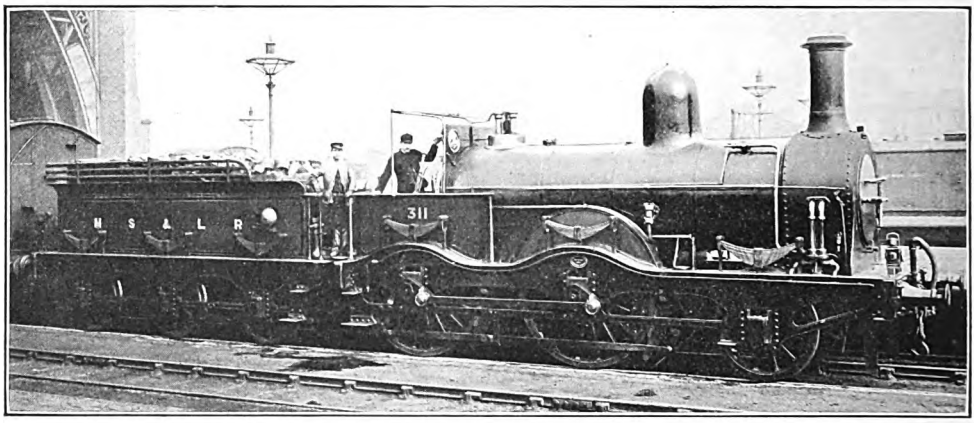

Photo] [*Loco. Publishing Co., Ltd.*

2-4-0 LOCOMOTIVE NO. 311 (311-320 CLASS, WITH OLD NUMBER PLATE REMOVED).

Locomotive and Train Working in the latter part of the 19th Century.

THE MANCHESTER SHEFFIELD AND LINCOLNSHIRE RAILWAY. [No. I.]

By E. L. AHRONS, M.I.Mech.E., M.Inst.Loco.Eng.

AS the Great Central Railway, this is now one of the leading main lines connecting London with the North, but was at the period with which I am dealing, a provincial railway, of which the main line ran from West to East, through Lancashire, Cheshire, and South Yorkshire, to the North Lincolnshire Coast. Its prerogative to the standing of a leading main line was principally derived from its ancient connection at Retford with the Great Northern Railway, as a result of which the through trains and coaches of the latter company from King's Cross were taken by Manchester, Sheffield and Lincolnshire locomotives to Sheffield and Manchester. It was a plucky railway, having to overcome severe financial and physical conditions, and in Lancashire and South Yorkshire was frequently known as the "Money Sunk and Lost." The history of its struggle as the Manchester, Sheffield and Lincolnshire chrysalis to burst forth eventually in 1898 as the Great Central butterfly is too well known to need repetition. As the Manchester, Sheffield and Lincolnshire Railway it was formed by the end-on junction of two originally separate companies, the Sheffield and Manchester Railway and the Great Grimsby and Sheffield Railway. It was also one-third owner of the Cheshire Lines Committee's railways, which gave it an entry to Liverpool, and by agreement with the two other companies owning the Cheshire Lines (the Midland and the Great Northern), the Manchester, Sheffield and Lincolnshire Railway provided the whole of the locomotive power for the joint Committee's trains, except the through expresses and goods trains of the Midland which the latter worked themselves between Liverpool, Stockport, and Marple. The Midland Railway also

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worked three or four fast goods trains each way between Liverpool and Godley Junction, and forward to Barnsley over the Manchester, Sheffield and Lincolnshire line. From Barnsley these trains passed on to the Midland metals to reach their ultimate destinations, Bradford, Leeds, or Sheffield.

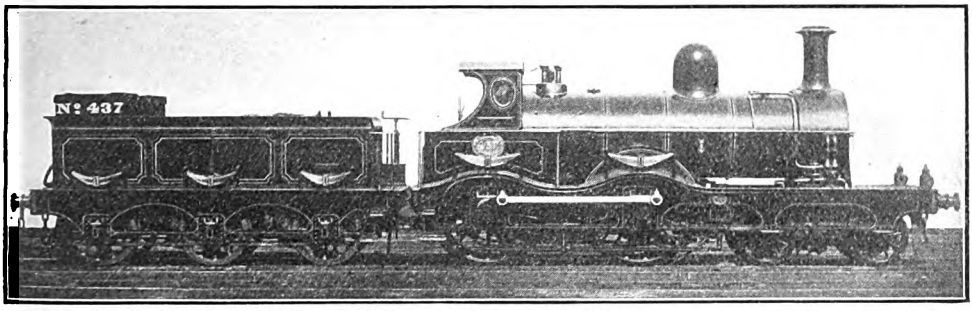
Returning to the Manchester, Sheffield and Lincolnshire main line from Manchester (London Road) eastwards, this was practically divided into two distinct sections, Retford being the dividing station, and the whole of the express service was confined to the section between Manchester and Retford, over which the Manchester connections with the Great Northern London trains ran.

Any mention of the Manchester, Sheffield and Lincolnshire road without reference to the gradients would be "Hamlet without the Prince of Denmark." The following extract is taken from "Express Trains," by Mr. E. Foxwell, published in 1884, and as no better description can be given, I feel that I cannot do better than quote it verbatim. Writing of the Retford–Manchester section, Foxwell says:—

"This is a route to breed energy. Of the 64½ miles from Retford to Manchester, seven only are easier than 1 in 200. On such a route a journey speed of 35 miles per hour would be express. From Retford it rises 3½ miles averaging 1 in 160; falls three more gently to Worksop; rises (two rests) seven miles averaging 1 in 150, and falls 3½ miles averaging 1 in 120 to Woodhouse Junction; rises three miles 1 in 145 to Handsworth tunnel, and falls 2½ miles averaging 1 in 150 into Sheffield.

"From Sheffield to Manchester it resembles the roof of a house, 18½ miles of unbroken ascent averaging 1 in 125 to the east mouth of the Woodhead tunnel, 1,010 ft., followed by a drop of 22½ miles averaging 1 in 145 (three easy) to Manchester."

It might naturally be thought that specially powerful locomotives would have always been employed over such a road, but this was far from being the case, for at no period until well within the present century were engines of more than average size employed. From 1859 until 1873 the type of express engine used was of the 2–4–0 variety, with double frames and outside cranks, having 6 ft. driving wheels and 16 in. by 22 in. cylinders. In 1873 a similar but larger class was built, with 6 ft. 3 in. wheels and 17 in. by 24 in. cylinders and 130 lbs. pressure. These engines, Nos. 311 to 320, were in their day excellent express locomotives, and justly earned a very good name with the enginemen. In 1877, however, more powerful machines were required, and Mr. C. Sacré, the Chief Locomotive Engineer, designed and built at Gorton the first batch of his celebrated 4–4–0 express engines, of which Nos. 423 to 434 (1877), 435 to 446 (1878), 128 and 129 (1879), and No. 4 (1880) formed the lot of twenty-seven. These had 6 ft. 3 in. coupled wheels and 17 in. by 26 in. cylinders and 140 lbs. pressure. The bogie had inside frames only, but the outside slotted frame of the engine was carried along to the front buffer beam, though it had no physical connection with the bogie. In the illustration of No. 437, the double ejector pipe for the Smith's simple vacuum brake will be noticed at the side of the smokebox.



4–4–0 LOCOMOTIVE NO. 437.
Built by Mr. Sacré at Gorton Works, 1878.
Coupled wheels 6 ft. 3 in.; cylinders 17 in. by 26 in.

The express trains of the Manchester, Sheffield and Lincolnshire Railway, like those of its partner, the Great Northern, were fitted with this non-automatic vacuum brake, which required two pipes between each coach. The double ejector on the engine, though not absolutely necessary, was

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generally used to separate the ejector working the brake on the engine from that connected with the brake on the carriages. The action of the brake was the reverse of that of the modern automatic vacuum. On approaching a stopping station the ejector was started and the brake blocks were applied by atmospheric pressure acting at the back of a diaphragm, from the front of which the air in the brake pipe was being withdrawn by the ejector.

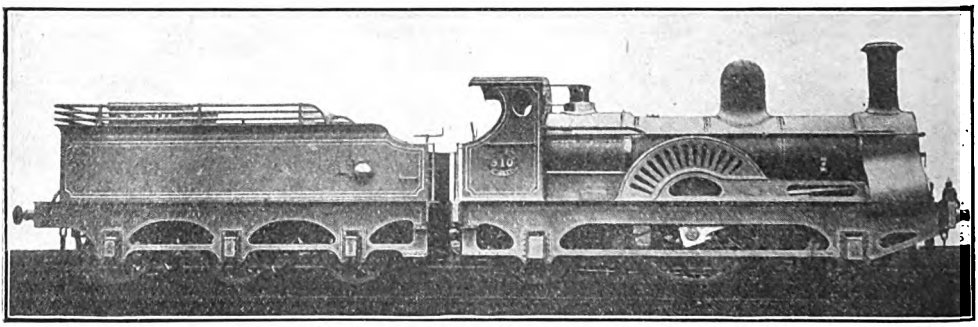
The 423 class bore practically the whole burden of the Manchester, Sheffield and Lincolnshire main line work for many years, and shared it in later years with other classes which came out after 1887. Nos. 423 to 432 were stabled at Gorton, 433 and 434 at Retford (also, I believe, 435 and 436), 437 to 439 were at Sheffield, and Nos. 440 to 446 at Liverpool, whence they ran through cross-country trains to Hull (North Eastern Railway Paragon station).

In 1880 there were four expresses daily from Manchester to Retford, and five in the opposite direction, all of which were connections with the Great Northern London expresses. The two principal expresses, the 10 a.m. and 5 p.m. from Manchester stopped at Guide Bridge, Penistone, and Sheffield, and the 12.40 p.m. and 3 p.m. called also at Godley Junction. The timing of the 10 a.m. from Manchester was characteristic of all the others, and was:

M.	CH.			a.m.	Speed.
—		Manchester (Lon. Rd.)	dep.	10.0	—
5	2	Guide Bridge ..	,,	10.11	40·0
28	29	Penistone	arr.	10.46	
			dep.	10.50	37·0
41	22	Sheffield	arr.	11.11	
			dep.	11.15	43·6
64½		Retford	arr.	11.47	

For some unexplained reason, the time allowance of 21 minutes for the downhill section from Penistone to Sheffield was the same as the uphill pull from Sheffield to Penistone for all trains; and it would appear that a driver of an up train from Manchester could open his regulator from Penistone to Barnsley Junction signal-box only, and then gently roll down the remaining 12 miles to Sheffield without steam, had he been so minded. And he could hardly have lost any time, even if he had tried hard to do so.

The best train in the opposite direction was the down "newspaper express" from King's Cross, which left Retford at 8.25 a.m., and arrived at Manchester at 10.5 a.m. This train took the standard express timing of 33 minutes from Retford to Sheffield, 21 minutes from Sheffield to Penistone, and then ran from Penistone to Manchester in 41 minutes, a speed of 41½ miles per hour. This was the only down train which did not stop at Godley Junction and Guide Bridge.



2-2-2 SINGLE LOCOMOTIVE NO. 510.
Built by Mr. Sacré at Gorton Works, 1883.
7 ft. 6 in. driving wheels; 17½ in. by 26 in. cylinders.

One of the up trains, the 12.40 p.m. from Manchester, was generally known as the "Boat Train," for in addition to the through London portion, it conveyed on Wednesdays and Saturdays through carriages to Grimsby Docks for the convenience of passengers for the Manchester, Sheffield and Lincolnshire bi-weekly steamers for Hamburg and Rotterdam. This train was worked by a Retford 4-4-0 engine, which had run the morning newspaper express 8.25 a.m. from Retford to Manchester. It was when running the "Boat Train" on July 16th, 1884, that engine 434 broke a crank axle at Bullhouse Bridge, near Penistone. The jolt caused a defective coupling between the tender and a horse-box to give way, and although the engine and tender kept on the

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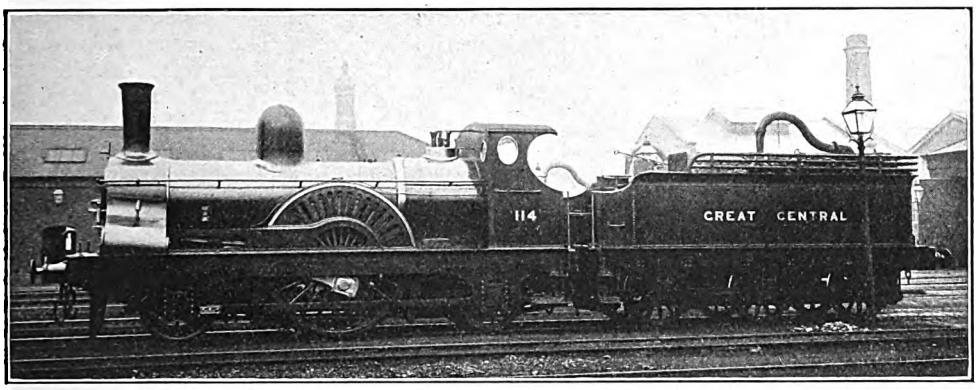

7 FT. 6 IN. SINGLE NO. 114 (FORMERLY NO. 509) AS RUNNING IN 1899.

The old connecting rods with marine pattern ends had at this date been replaced by ordinary ends, with cotters.

embankment and were hardly damaged, the train was, unfortunately, hurled down the side, with the sad result that 24 passengers were killed and over 60 injured. Included amongst them was Mr. Massey Bromley, who had three years before retired from the chief locomotive superintendency of the Great Eastern Railway. This accident raised a considerable discussion on the subject of crank axles, which in those days were more usually made of best iron, though a large number of steel axles (about 40 per cent.) were in use. It was also contended by some that outside cylinder engines with straight axles were safer.

Statistics specially taken out for the year 1883, however, showed the following results :

	Number in use.		Broken in running.		Taken out in Shops.	
	Iron.	Steel.	Iron.	Steel.	Iron.	Steel.
			per cent.	per cent.	per cent.	per cent.
Crank axles without hooped webs	2,867	4,733	3·1	0·9	6·0	3·8
Crank axles with hooped webs ..	4,121	1,222	0·85	0·9	7·7	0·7
Straight axles outside cylinders ..	438	1,467	5·0	0·5	2·7	0·8

The above table showed that a large percentage of straight driving axles broke in service, so that the adherents of outside cylinder engines gained no consolation from this. Nevertheless the accident did good in drawing attention to the subject, and the modern strengthened crank axles, such as the Midland pattern with a bolt through the crank pin (an old design until then little used) and the Worsdell crank axle with circular webs, were perhaps directly due to the stimulus which the subject had received.

In the summer of 1883 the Great Northern Railway and Manchester, Sheffield and Lincolnshire Railway determined to make a strong bid to recover some of their through London-Manchester passenger traffic, into which the Midland was making heavy inroads, and jointly the two partners instituted a fast express service, consisting of two trains in each direction, which stopped at Grantham and Sheffield only. These trains were booked to run the whole journey in 4½ hours, and in order to do away with the Retford stop it was arranged that the Manchester, Sheffield and Lincolnshire Railway engines were to run both up trains from Manchester right through to Grantham, returning thence with the down trains. This arrangement continued in force from 1883 until the Manchester, Sheffield and Lincolnshire Railway—renamed the Great Central Railway—opened its new route in 1899 to Marylebone.

In 1883 the new expresses were allowed 61 min. in both directions between Manchester and Sheffield (speed 40·6 miles per hour) and the down trains covered the 56½ miles from Grantham to Sheffield in 74 min. (45·8 miles per hour), whilst the up trains took 76 min. from Sheffield to Grantham.

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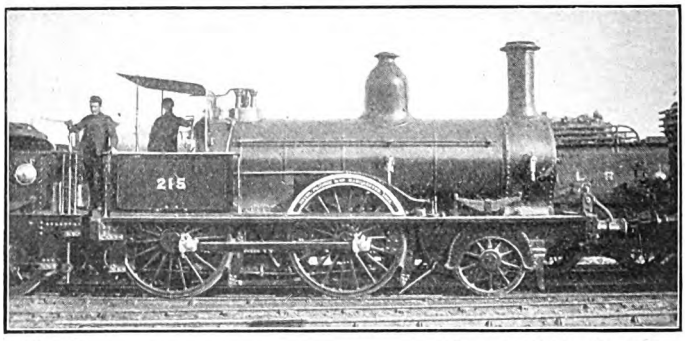
These timings include the severe slack at slow speed from Whisker Hill junction signal box (West Retford) round the very sharp curve to Retford Great Northern station, the speed restriction for half a mile being 15 miles per hour.

In 1884 these trains were accelerated to run between Manchester and London in 4¼ hours, the down express—2 p.m. from King's Cross—being booked in 68 min. from Grantham to Sheffield (50 miles per hour), including, of course, the Retford slack, and the time from Sheffield to Manchester was reduced to 59 min. (41·7 miles per hour). The loads of these trains were light; all my notes of the period indicate "5 coaches" between Manchester and Sheffield, where another coach from Bradford (Lancashire and Yorkshire) *viâ* Penistone was added. If one coach be taken as about 14 tons, a fair estimate of the load may be obtained.

a somewhat unsteady "boxing" movement from side to side. The carrying wheels were only 3 ft. 8 in. in diameter and the heating surface was 1,144 sq. ft., towards which total the firebox supplied 87 sq. ft. The weight on the driving wheels was as much as 17 tons 11 cwt. This first engine was numbered 399, and immediately earned the soubriquet amongst the men of "Robert the Devil." It was one of those Manchester, Sheffield and Lincolnshire engines which hardly ever throughout its existence did any work on the Manchester, Sheffield and Lincolnshire Railway proper, for from its earliest start it was quartered on the Cheshire lines to run between Manchester and Liverpool. Unlike the eleven engines which followed it rather more than a year later, it had, when I first saw it in 1882, closed splashers, but these were subsequently altered to the standard form shown in the



Photo] [*Loco. Publishing Co., Ltd.*

OLD BEYER PEACOCK 2-4-0 LOCOMOTIVE NO. 215.

Something must now be said as to the engines which worked these trains. I do not remember that the 4-4-0 engines (423 class) ever worked them, though they may have made, and probably did make, occasional journeys on them.* In the early part of 1882, Mr. Sacré designed and built at Gorton a single express engine with 7 ft. 6 in. driving wheels, and outside cylinders 17½ in. by 26 in. and 140 lbs. pressure. The framing was somewhat after the style of the Crewe-Caledonian pattern designed by R. Trevithick and developed by Alexander Allan. If one may be permitted to criticise the design of this engine, the chief fault lay in the short wheel base, only 15 ft. 9 in. long. This, combined with the outside position of the cylinders, gave the engines

illustration of No. 510. The eleven succeeding engines, Nos. 500 to 510, followed in May to November, 1883. Of these, six followed No. 399 on to the Cheshire lines, but Nos. 500, 507 and 508 were stabled at Gorton to run the accelerated London expresses between Manchester and Grantham, and two were sent to Sheffield principally to "stand pilot" for the same trains in case of necessity.

I had one or two runs on which I timed Nos. 500 and 508 on these fast trains. On one occasion, with engine No. 500 and a load of about 70 tons, the train (2 p.m. from Manchester) passed the 18th post between Crowden and Woodhead in 27 min. 1 sec. from the start, the lowest speed up the bank being 39·1 miles per hour from the 15th to the 18th post. On the downhill side of Woodhead Tunnel to Sheffield the maximum speed never exceeded 58 miles per hour near Deepcar. The speed through Penistone was

* Since the above was written, I find that the 423 class (4-4-0) did run these trains on various occasions, when the single engines were laid off.

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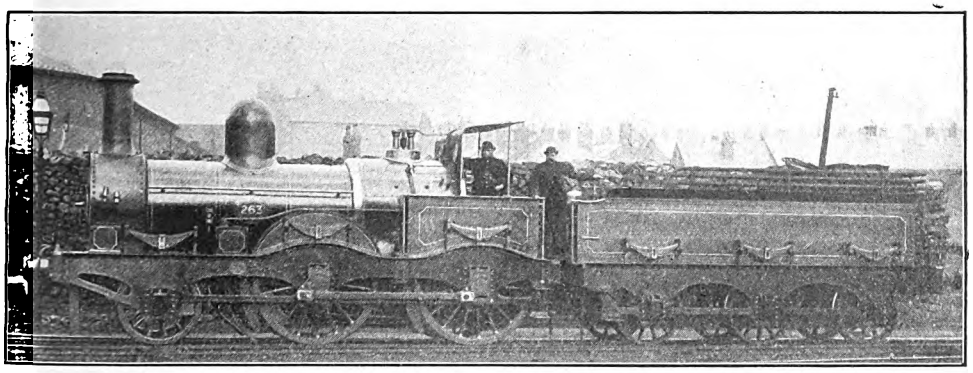
45 miles per hour. The exact time from Manchester to Sheffield was 58 min. 28 sec., a gain of about half a minute on the booked timing. Leaving Sheffield with 84 tons, a speed of 61 miles per hour was attained at the 47th post from Manchester, and 60 was again reached between Checker House and Retford, and through the latter station the speed did not exceed 7 miles per hour. Once on the Great Northern metals, No. 500 was somewhat "let out" by the driver, and the speed from Retford to the top of the rise gradually increased to 55 miles per hour, and then rose to 72 miles per hour at the end of the next 5 miles to the 128th post. Newark was passed in 19 min. 53 sec. from Retford ($18\frac{1}{2}$ miles). Although the train had left Sheffield 46 sec. late, and was slackened by signals outside Grantham, it pulled up in Grantham station 1 min. 22 sec. before time, having run the $56\frac{1}{2}$ miles in 67 min. 52 sec., the time allowance being 70 min. On another occasion No. 508 gave me an almost identical timing from Sheffield to Grantham with the old 11.30 a.m. from Manchester, details of which need not be repeated.

On this occasion I had come from Bradford in the through carriage to King's Cross *viâ* the Lancashire and Yorkshire route through Huddersfield to Penistone, to which I have already referred in dealing with the Great Northern Railway. Originally this connection existed to Huddersfield only, and formed the only through route between that town and London. Afterwards the through coaches—which were always provided by the Great Northern—were worked from Bradford (Lancashire and Yorkshire) by a Lancashire and Yorkshire tank engine. At Huddersfield a Manchester, Sheffield and Lincolnshire 2–4–0 tender engine (260 class) worked the through coach and train to Sheffield, and owing to turn-table difficulties at Huddersfield the journey was frequently performed tender first. But the drivers of the two railways with which the late Sir Edward Watkin was connected, the Manchester, Sheffield and Lincolnshire and the South Eastern Railway, were quite accustomed to this, and performed a very large percentage of tender-first mileage.



MANCHESTER, SHEFFIELD AND LINCOLNSHIRE RAILWAY.
2–4–0 locomotive No. 263, built at Gorton Works by Mr. Sacré in 1868.
6 ft. coupled wheels, 16 in. by 22 in. cylinders.

This branch connection was the parent of the present-day fine corridor trains which run over the same route from Bradford (Lancashire and Yorkshire) to the Great Central main line, but they are now generally headed between Bradford and Sheffield by the Lancashire and Yorkshire Railway large 4–6–0 four-cylinder main line engines.

(*To be continued.*)

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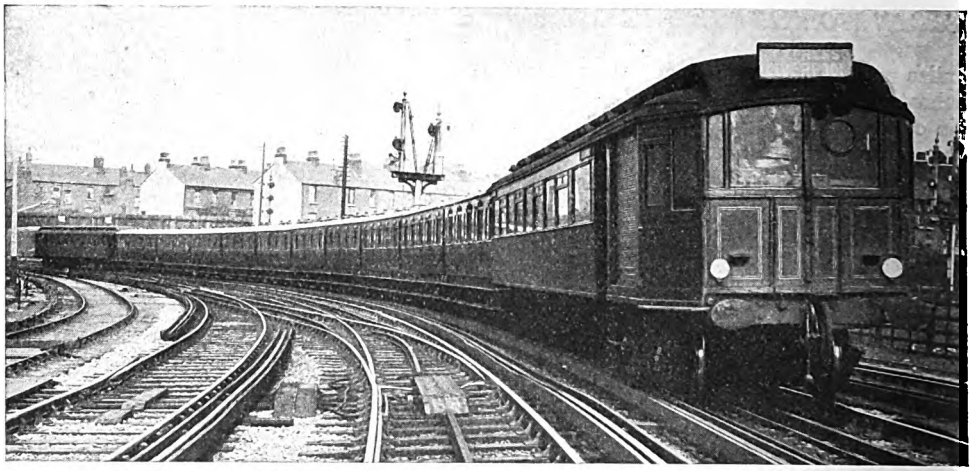

"RACE SPECIAL," LANCASHIRE AND YORKSHIRE RAILWAY, FORMED OF ORDINARY COACHES WITH ELECTRIC MOTOR CARS AT EACH END.

Railway Electrical Progress and Practice.

By "INDICATOR."

ALTHOUGH due entirely to modern developments in railway traction the seating arrangements adopted, or desirable, for rolling stock on electric lines is already an old topic of controversy. At the same time the subject is one of considerable interest, and a few remarks thereon, leading up to a description of the most remarkable development of practice in this connection, will be in place, seeing that this matter is closely interwoven with certain economic aspects of electric railway operation.

Rolling stock of ordinary types for electric haulage may be quickly dismissed. The case is then purely that of the use of electric instead of steam locomotives, complicated only by the fact that in many instances such trains also have to work over "intense-traffic" sections of line, with numerous stops, large numbers of passengers frequently entering and leaving, and subject to the high accelerative features associated with electric traction on urban lines. Ordinary vehicles can be, and are used under such conditions; but it is generally necessary to take into account the need for distribution of passengers to avoid local over-crowding, the fact that the opening and closing of numerous doors calls for a relatively numerous platform staff, and that every aid to dealing with traffic expeditiously must be adopted.

For these reasons "slam" locks to doors are almost inevitable, in order to ensure that no train shall leave a station with any doors unfastened, while there are several instances where means of inter-communication between compartments are afforded so that passengers may be able to distribute themselves while the train is on the move. Thus on the Metropolitan Railway many of the more modern steam-stock coaches have the third-class compartments connected in sets of two or three by central openings, while the vehicles used on the South London line by the London, Brighton and South Coast Railway have side gangways for a similar purpose.

It has been claimed that, after all, the separate compartment system is best for electric lines, seeing that the entrance and egress of passengers is localised to each compartment, instead of being concentrated upon the fewer doorways characteristic of car-stock. As a broad statement this can hardly be accepted, as the looking about for suitable compartments by passengers, and the large number of doors whose closure must be seen to by the platform staffs as each train leaves, constitute serious sources of delay on intense-traffic sections at busy periods. But with adjuncts such as the central or side gangways and the general use of slam locks for doors most of the objections are overcome, and in practice

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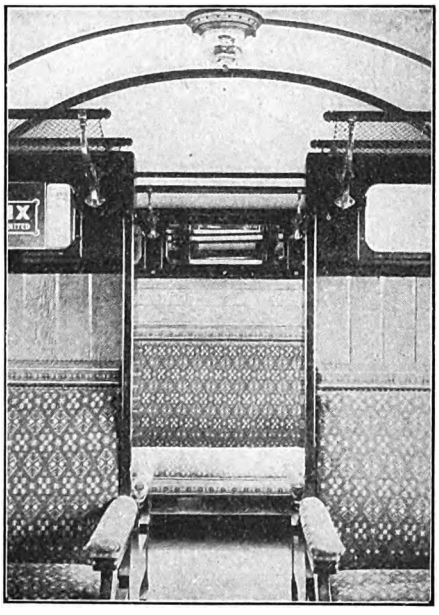
SIDE GANGWAY AS PROVIDED IN SOUTH LONDON ELECTRIC STOCK, LONDON, BRIGHTON AND SOUTH COAST RAILWAY.

compartment trains may be dealt with as expeditiously as, and sometimes more so than, the more general car stock. That there is not so much in the matter as is sometimes suggested is shown by the fact that on the London, Brighton and South Coast Railway stock of ordinary types is used for all services except those worked by the original South London side-gangway coaches; though it must be admitted that most of the other services are more of a usual suburban character, and there are several factors which have prevented extension of the use of side-gangway vehicles. The statement that the reduction of seating space due to the provision of side or central gangways is an important factor cannot, however, be accepted altogether, seeing that normally the facility for distribution given with inter-communicating compartments usually realises about the same total seat occupancy in, say, three compartments, as where the compartments are separated, two perhaps being fully occupied, while the third may have two or three vacant seats, even at the busiest periods.

Where rolling stock has to work both on steam and electric sections regularly there is much to be said for the practice of building special car stock adapted for both purposes, though the only instance where this is done is afforded by the trains provided by the Midland Company (London, Tilbury and Southend section) for the Ealing-Southend services. In this instance there is, perhaps, special justification; at the same time these trains are usually conveniently dealt with on the electric sections and the type of vehicle adopted is also highly appreciated by travellers on the steam sections of the journey.

It is, however, when the design of car stock is considered that the question of seating arrangements becomes of most account. On the old City and South London Railway the tramcar method of seating is adopted, with merely two long seats along each wall, and this is found in many of the District motor-cars, and also on some of the tubes. The more usual arrangement is, however, to include one or more sets of facing transverse seats, with central gangway, about midway between the doors. Thus, with end doors only, there may be seats for about six passengers longitudinally on each side adjacent to the doorways and two or three sets of facing transverse seats between. With middle doors also provided, there will be usually one set of transverse seats with longitudinal seats towards each



CENTRE GANGWAY AS PROVIDED IN LONG DISTANCE COMPARTMENT ROLLING STOCK WORKING OVER ELECTRIC SECTIONS, METROPOLITAN RAILWAY.

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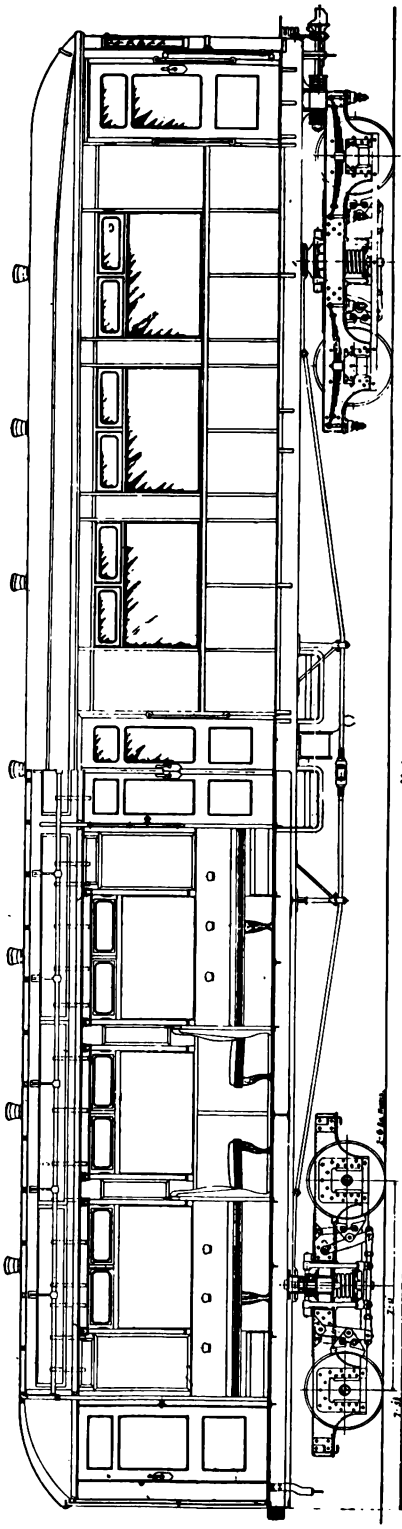
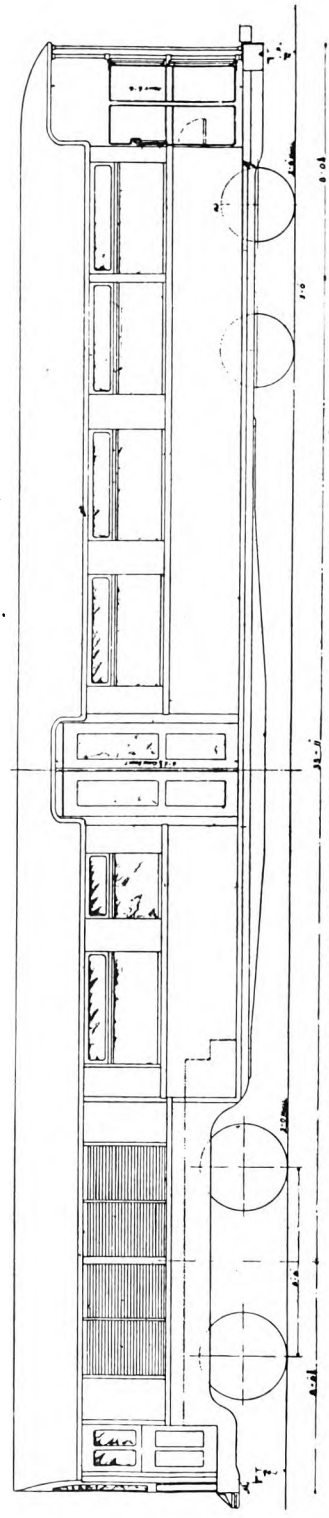


STEEL TRAILER CAR WITH LONGITUDINAL AND TRANSVERSE SEATS AND MIDDLE DOORS, METROPOLITAN DISTRICT RAILWAY.



STEEL MOTOR CAR, MIDDLE DOOR TYPE, LONDON ELECTRIC RAILWAY.

PLAN OF LANCASHIRE AND YORKSHIRE TRAILER FIRST-CLASS AND MOTOR THIRD-CLASS CARS.

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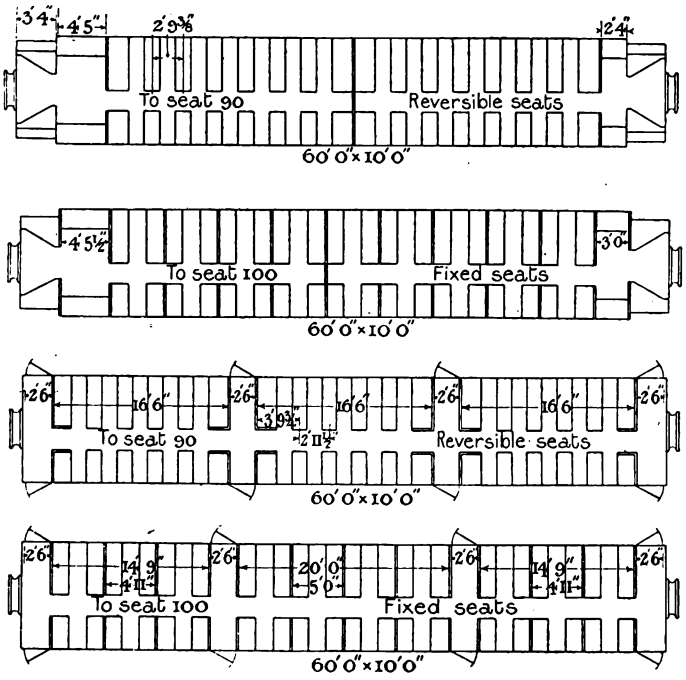
door. This method has the great advantage that while passengers who prefer transverse seats have a choice as far as the numbers travelling will permit, and one set of transverse seats will probably seat eight passengers in a space which would serve only for six longitudinally, three on each side, there is ample central space adjacent to the doors for the entrance, egress and distribution of passengers.

Some lines, however, adopt transverse seats, with central gangway, wholly or mainly; but in this case the question of available width of body becomes a matter of serious import. Early last year Mr. H. E. O'Brien, Assistant Mechanical Engineer, Lancashire and Yorkshire Railway, read a paper before the Institution of Electrical Engineers on "The Design of Rolling Stock for Electric Railways," in which he discussed some of the problems involved in providing maximum seating capacity in view of traffic requirements and engineering considerations. He pointed out that in designing cars to give a maximum seating capacity for a minimum weight a careful investigation of the maximum possible width is the first essential, because extra seats can be given by extra width with a smaller increase in weight rather than by extra length. In settling the dimensions of the cars the ultimate range of the rolling stock must also be considered, but he did not consider it necessary or desirable to make suburban stock of such dimensions that it will conform to the minimum loading gauge for the whole of the system.

If 60-ft. coaches are used, he estimated that an extra 12 in. in width will give 15 more seats on a basis of 4 sq. ft. per passenger; the width of the gangway must be 2 ft., and consequently if the cars can be made 10 ft. wide, instead of 9 ft., five seats can be given crosswise instead of four. If the average coach seats 100, ten more seats per car will result in a 10 per cent. decreased capital expenditure on rolling stock.



DIAGRAMS SHOWING SEATING CAPACITY WITH REVERSIBLE SEATS COMPARED WITH THE USE OF FIXED SEATS.

The length of the coach is determined by the throw of the coach, the versed sine of the worst curves on which trains will pass each other, and the minimum width between the tracks at that point. With corridor coaches, or side-door coaches with doors opening inwards or sliding doors, a very small clearance can be adopted with safety.

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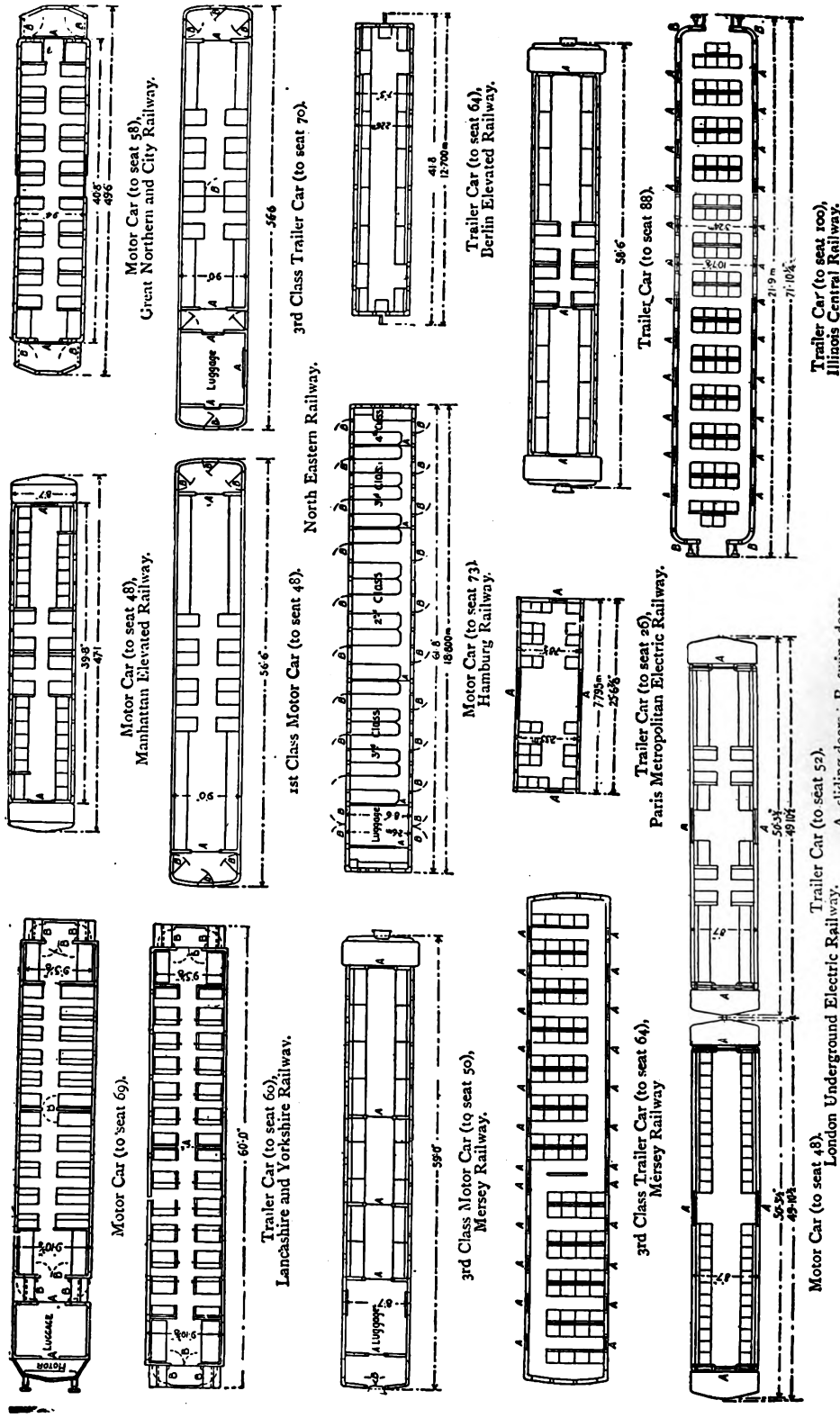

DIAGRAMS SHOWING VARIOUS SEATING ARRANGEMENTS USED FOR ELECTRIC ROLLING STOCK.

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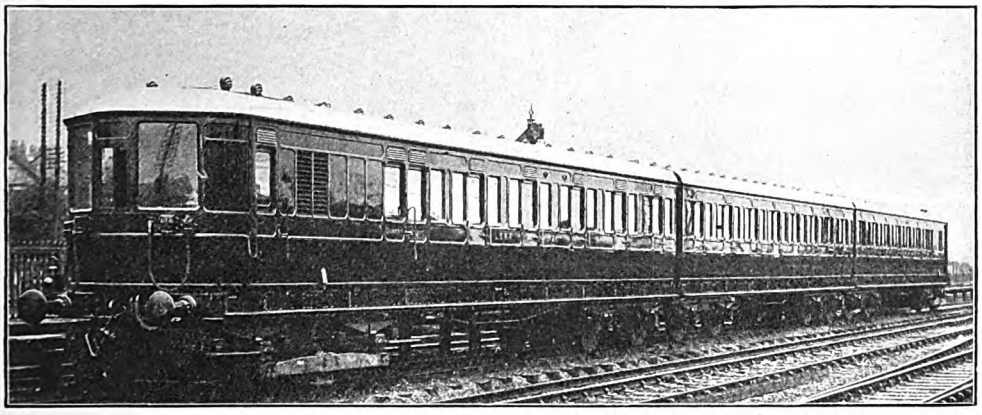
Mr. O'Brien continued by pointing out that if traffic considerations permit, fixed seats should be used, with a consequent increase in the seating capacity of approximately 10 per cent. per car, which is, of course, equivalent to an eventual reduction of 10 per cent. in the total weight of the rolling stock to be moved. It is becoming generally recognised that on the comparatively short journeys made by suburban rolling stock the public do not mind which way they sit; consequently fixed seats should always be used.

A figure from this paper is reproduced on page 135, showing in diagrammatic form how fixed seats provide the increased seating accommodation. It is advisable to allow a certain amount of open space in the vicinity of the gangways, as this forms a sort of reservoir for passengers to stand in when they are getting in and out simultaneously, or when a large number of people are getting out at the same time.

On the Lancashire and Yorkshire Railway, with 10 ft. bodies, as shown on page 134, in the first-class cars, with some of the seats of reversible type and only a very few longitudinal seats, accommodation is provided for 66 passengers; while in third-class vehicles, which also include motorman's and luggage compartments, and with fixed transverse seats, for two passengers on one side of the gangway and three on the other side, no fewer than 69 passengers can be seated per vehicle. These have vestibule doors only, but on the London lines it has been shown to be almost imperative to provide a middle door in addition, and this course renders it desirable to provide more longitudinal seats so as to give adequate circulating and standing space adjacent to all doorways.

The whole subject is effectively reviewed by a series of diagrams included in Mr. Philip Dawson's valuable articles on electric traction contributed to *Modern Railway Working*, and reproduced on page 136, from that useful reference work. Mr. Dawson gives a cosmopolitan selection of examples. The Hamburg motor car is somewhat similar to the system adopted for the South London trains here, while the Mersey third-class trailer, and the Illinois Central trailer set forth extreme developments of the side corridor principle. The Lancashire and Yorkshire Railway examples to some extent duplicate the diagram already referred to, but do not set forth the fact that the first-class cars have some of the seats reversible.



ELECTRIC COMPARTMENT TRAIN, LONDON AND SOUTH WESTERN RAILWAY.

In conclusion brief reference may be made to what is probably the most remarkable development of electric car design yet realised, as recently introduced for service in New York. To design a car having a capacity approximately 75 per cent. greater than those already in use, and without increasing axle loads or sacrificing strength or essential features of design was the problem placed before the designers of these new cars for the New York Municipal Railway Corporation, for operation on the lines allotted to the Brooklyn Rapid Transit system.

Comparing the capacity of the new car with the latest steel cars of the Interborough Rapid Transit Company operating in the New York subway, there is an increase of from 77 per cent. to 95 per cent. in the seating capacity in favour of the new

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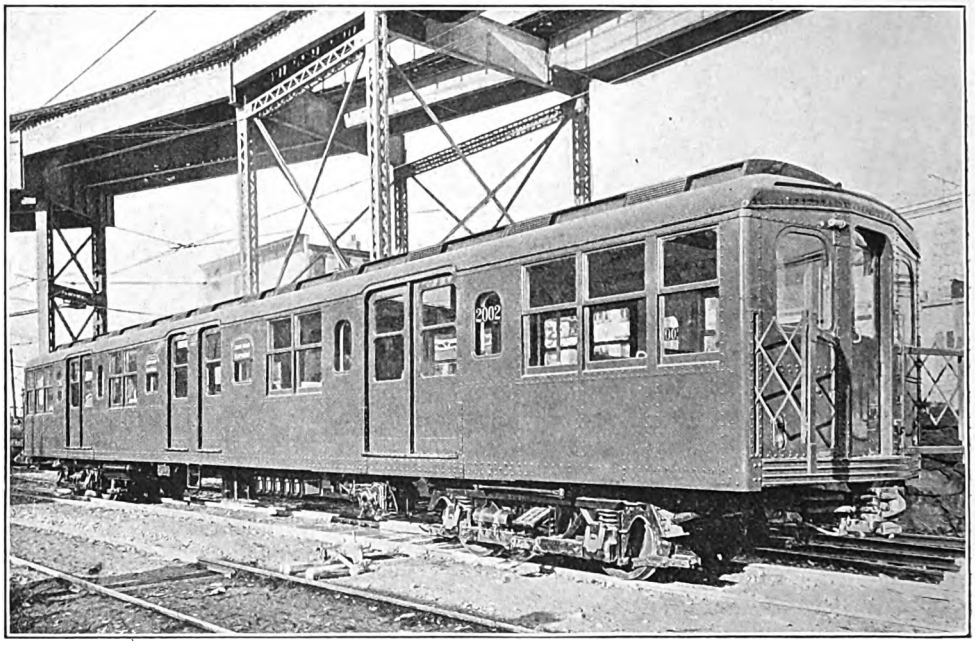
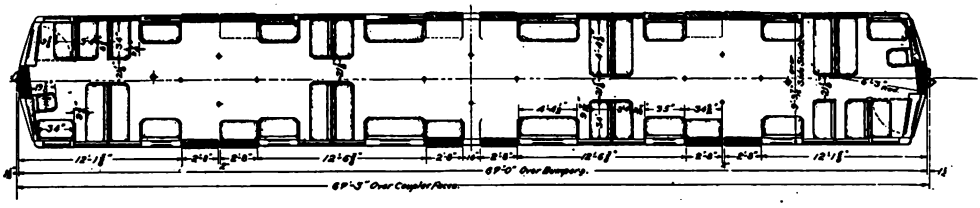
avoiding confusion due to entirely closing certain exits where folding seats are used.

In the design of the seat itself, the New York Municipal Railway secured the co-operation of the American Posture League, a national organisation of orthopedic experts. The new seat holds the passenger firmly and comfortably in a correct upright posture and its very correctness of design discourages attempts to get into an incorrect posture.

connected to a bracket on door, the air being controlled through one electro-pneumatic valve for each pair of side doors and one valve for each end door, operated by push buttons located on pillar between centre doors. The push buttons are arranged so that by pressing of one button all doors available for use on one side of car will open, while a separate button is provided for the closing of each pair of side doors. When the folding seat at any door is down





NEW 6-DOOR CAR OF SPECIAL DESIGN INTRODUCED ON THE NEW YORK MUNICIPAL RAILWAYS.

There are six doors in pairs on each side of the car for ingress and egress, and one door in each end for passing from car to car. Side doors are spaced so as to facilitate movement of passengers and reduce length of train stops at stations. The doors for each car are controlled by trainmen located in the middle between the two centre doors, thus affording him full view of all doors under his control. Each door is operated by a single double-acting air cylinder, directly

the air is automatically cut off from the cylinder of that door, and a mechanical latch engages same so that it cannot be opened. Separate buttons are provided both for opening and closing each door in end of car.

A signal circuit connected through interlocking switches placed in plain view behind swing sash in door pockets, is provided and arranged to open and close coincidently with the opening and closing of doors. The

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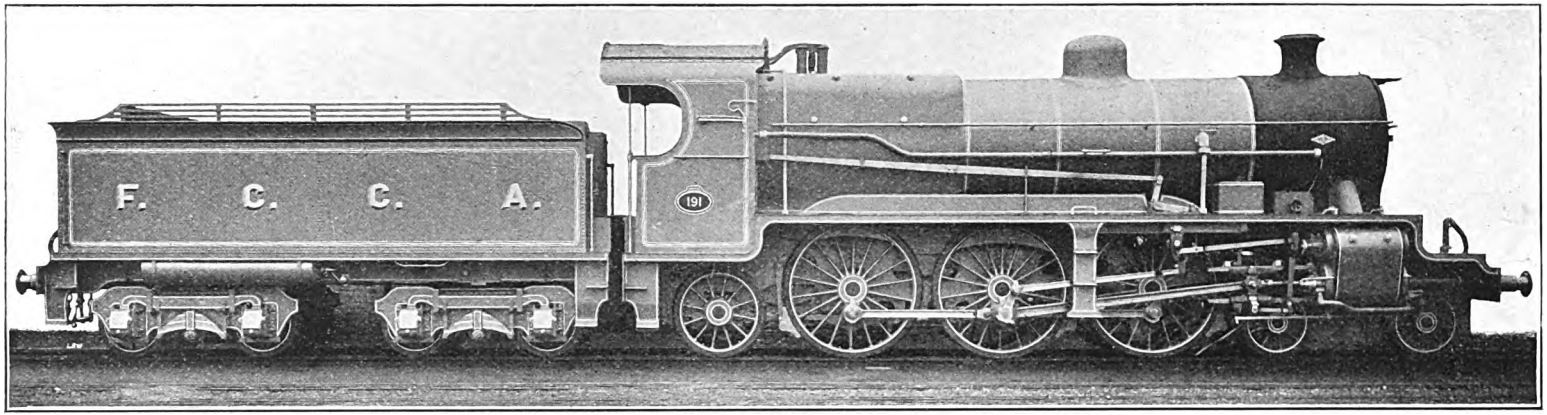
NEW 4-6-2 LOCOMOTIVE, CENTRAL ARGENTINE RAILWAY.



4-6-2 SUPERHEATER ENGINE FOR EXPRESS PASSENGER TRAFFIC: CENTRAL ARGENTINE RAILWAY.

Designed by Mr. J. P. Crouch, Chief Mechanical Engineer, and built by the North British Locomotive Co., Ltd.

New 4-6-2 engines have been recently placed in service on the Central Argentine Railway, there being twenty for general passenger traffic, and ten of a larger class for express traffic. A further series of twenty engines is under construction, but will be practically identical with the general passenger class. All have been designed by Mr. J. P. Crouch, Chief Mechanical Engineer, Central Argentine Railway, and built at the works of the North British Locomotive Company, to whom we are indebted for the photograph reproduced showing an engine of the larger class.

These locomotives are fitted with Robinson superheaters, and replace saturated steam engines hitherto employed. The express class is intended to cope with an accelerated train service to be inaugurated shortly. Both designs include features of interest, and are notable for the large firebox and other dimensions, neat outline, etc. Steam distribution is controlled by Walschaert valve gear working 10 in. piston valves with inside admission. General equipment includes automatic vacuum brake on both engine and tender, mechanical lubricator, self-acting restarting injectors, screw reversing gear, pressure release valves with silencer, louvre spark arrester and oil gas installation.

Leading dimensions are as follows:—

Gauge	5 ft. 6 in.
Diameter of coupled wheels	6 ft. 2½ in.
Cylinders	20 in. × 26 in.
Working pressure	160 lb.

Heating surface:	
Water contact (tubes)	1,557 sq. ft.
Superheater elements (fire contact)	460 sq. ft.
Firebox (water contact)	189 sq. ft.
Total heating surface	2,206 sq. ft.
Area of grate	32.5 sq. ft.
Total weight (engine)	78½ tons.

The general traffic engines differ only in that the coupled wheels are 5 ft. 8 in. diam. Weight in working order is 77 tons 4¼ cwt.

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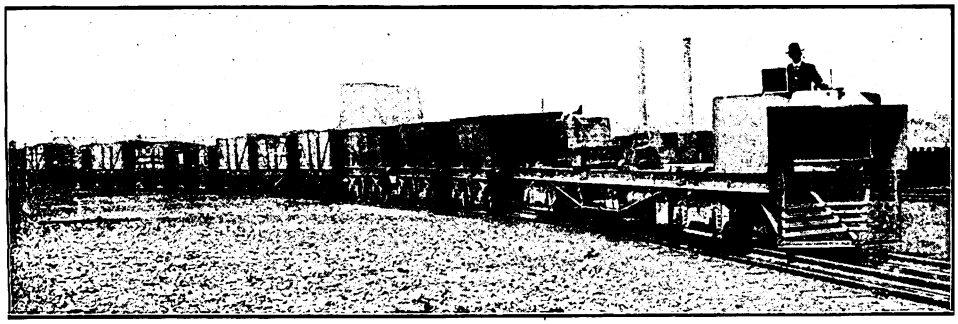

200 H.P. "THOMAS TRANSMISSION" RAIL MOTOR CAR (CHASSIS ONLY) HAULING A GROSS LOAD OF 200 TONS.

Petrol-Electric Car for the New Zealand Government Railways fitted with Thomas Transmission.

RECENTLY we inspected at the works of the Midland Railway Carriage and Wagon Co., Ltd., in Birmingham, the chassis of a petrol-electric car built for the New Zealand Government Railways to the designs of the Thomas Transmission Ltd. A car on the Thomas system was supplied some time ago to the South African Government Railways. This rendered good service, though after it was sent out various difficulties had to be overcome, not the least being the rarefaction of air at high altitudes on routes where the car was run, calling for modifications of the air supply valves and the carburetting arrangements. The car, however, showed very favourable efficiency; and the present car includes the results of experience with its forerunner, besides modifications based upon further engineering development. A noteworthy feature is that this car is not intended to meet light requirements. It is, in fact, a large-power machine for arduous duties, involving not only working over heavy grades but it is also designed to take loads substantially greater than that carried on itself.

The car now ready for despatch is fitted with a 200 h.p. engine, manufactured by Messrs. J. Tylor and Sons, Ltd., of London. The conditions of service as specified are exceptionally severe. It is required to carry passengers and haul a 25-ton trailer up a grade of 1 in 40 at 15 miles per hour, the gross load being about 60 tons. The maximum speed on the level will be just over 40 miles per hour, and it is estimated that the vehicle will haul a gross load of 85 tons up the 1 in 40 grade at about 10 miles per hour. The coach alone will take the specified grade at a speed of 28 miles per hour. The seating capacity of the vehicle will be for about fifty passengers. In ordinary service the vehicle is capable of hauling two 25-ton trailers each carrying its full complement of passengers, so that the total number of passengers will be about 150.

The chassis only has been made here, as the superstructure is to be built in New Zealand and added there. It is mounted on two four-wheeled bogies of 5 ft. 10 in. wheelbase, on centres 38 ft. apart, the length of the underframe being 58 ft. As the gauge is only 3 ft. 6 in. this will be a large vehicle. At each end is a V-shaped driver's compartment. In the centre is an engine compartment 8 ft. 3 in. long, and on either side are 14 ft. 2 in. passenger compartments fitted with seats for passengers as already noted, with a 5 ft. luggage compartment on one side of the engine compartment. Entrance to the two passenger compartments is obtained from the end platforms, the driver's space being separated from the vestibules adjacent by collapsible gates. The actual body of the car is 42 ft. 11 in. in length and 8 ft. wide.

The Thomas system comprises essentially the use of two electrical machines (each about one-third the normal horse-power of the prime mover) and a planetary gearing which interconnects these electrical machines with the engine and the load. On top speed all the power is transmitted direct mechanically, and in starting and climbing heavy grades part of the power is transmitted mechanically and part electrically. It is this division of the power at these periods and the direct drive on top speed which provides the special flexibility and efficiency claimed for the Thomas transmission system. It is important to note that in a vehicle of this type the engine is only actually running and using fuel when it is doing useful work, so that there is not the enormous waste of fuel which is met with in all steam locomotives. It is estimated that the fuel consumption will

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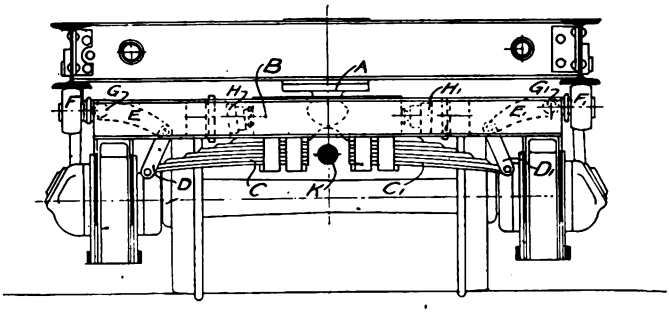

"THOMAS" COMPENSATING BOGIE.

be about 200 ton miles per gallon of petrol on a give-and-take route, and there is no reason why this should not be improved upon in actual service.

On the occasion of our visit the chassis of the car, virtually ready for shipment, was run with a load upon it and attached of 120 tons, and within the limits of the length of track available showed interesting results. The problem of adapting the internal combustion engine in this way is a complicated and difficult one, but there is every reason for expecting interesting results from the performances of this car in New Zealand.

The car just described is, incidentally, fitted with a design of compensating bogie which possesses features of interest apart from its application in the New Zealand petrol-electric vehicle. A drawing of this bogie is reproduced. The ordinary king pin and pivot plate is replaced by a spherical headed pin A, which is supported in a bolster box B provided with a spherical socket to receive the pin A. This bolster box has a cover which fits round the neck of the spherical pin A and prevents any lifting from the spherical socket. The bolster box B is supported on laminated springs C-C^1, which at their ends are supported on swinging links D-D^1. These links are suspended from the ends of bent levers E-E^1, which carry at their opposite ends supporting rollers F-F^1, the latter bearing upon the sole bars of the main frame of the coach. These rollers take the place of the friction plates provided in the usual construction of bogie. The levers E-E^1 are carried on fulcrum pins G-G^1 which are supported in brackets on the bogie frame. In order to prevent excessive swinging of the body, coned coiled springs H-H^1 bear upon the sides of the bolster box B. It will be clear from the construction shown that the ordinary bogie bolster is replaced by the bolster box B and the springs C-C^1, The weight of the main frame with power equipment and body is distributed between the spherical pin A and the two rollers F-F^1, the whole weight being therefore supported on the fulcrum pins G-G^1. The distribution of this weight can be varied according to requirements, by adjustment of the relative lengths of the arms of the levers E-E^1. If considered advisable, half the weight can be carried on the bolster box B and one quarter on each of the rollers F-F^1. The object of this construction is to keep the weight distributed between the main spherical pin A and the side rollers F-F^1 and also to minimise rolling of the body.

It will be clear from the above description that the first object has been achieved, and a consideration of the construction will show that rolling of the body will be limited to a very great extent. To make this clear, let us assume that the vehicle is rounding a curve and cants towards one side, say, to the left. This will cause a depression of the roller F and the end of the lever E which carries the link D will rotate upwards; owing to the bend in the lever this upward motion will also be slightly inwards towards the centre of the bogie. On the right hand the motion will be reversed the roller F^1 will be raised and the end of the lever E^1 supporting the link D^1 will rotate downwards and outwards. This motion of the levers supporting the links will move the springs and bolster box together with the main frame slightly towards the right, and transfer some of the weight from the roller F to the roller F^1. This will cause a slight depression of F^1, thus tending to restore the body to its horizontal position. The action described above tends to increase as the one roller becomes more depressed, owing to the fact that the face of the roller is curved and the lever bent in the manner shown. If depression of, say, roller F takes place, the weight is transferred from the centre of the roller slightly towards its inside edge to a smaller diameter, thus reducing the effective length of that arm of the lever. Further, as the inner end of the lever is raised, the effective length of the longer arm of the lever increases. In order to allow free movement of the rollers transversely when the main frame moves from side to side, coiled springs are fitted on the ends of the levers on either side of the rollers. These springs tend to keep the rollers in a central position, but if movement takes place the spring on one side becomes compressed. The springs C-C^1 could be made in one piece, but in this particular design they had to be divided in order to allow a passage for the propellor shaft K which passes through to the outside axle. A very important feature of this construction is that it is simpler and cheaper than the ordinary standard design of bogie bolster.

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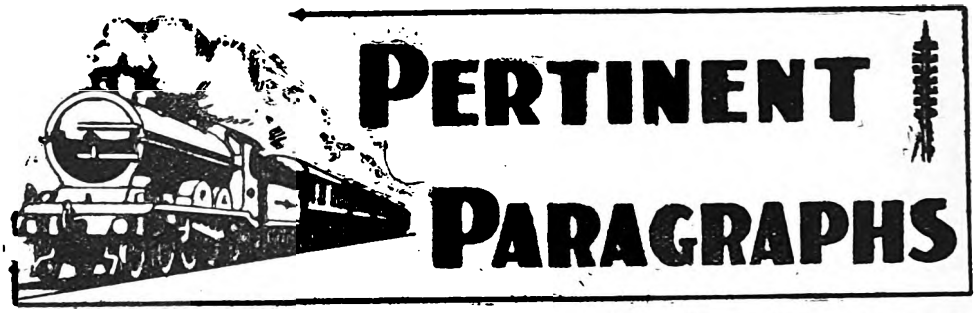

New Ambulance Train for France.

A HOSPITAL train built by the Lancashire and Yorkshire Railway Company for the use of our troops in France was on view at Exchange station, Liverpool, on July 9th, between 12 noon and 6 p.m. The train was in charge of a section of the Lancashire and Yorkshire Railway Company's St. John Ambulance Corps. By charging 1s. to view the train a considerable sum of money for comforts for the wounded was handed over to the auxiliary military hospitals in Liverpool. The train consists of 16 carriages, as follows: 1 brake van with stores (with accommodation for guard); 1 kitchen car (3 cooks); 4 ward cars (144 lying-down cases); 1 pharmacy car; 1 staff car (4 medical officers, 4 nurses); 4 cars for sitting-up cases (256 patients); 1 car for sitting-up infectious cases (64 patients); 1 kitchen car (3 cooks); 1 staff car (32 persons); 1 brake van with 2 infectious wards (18 infectious lying-down cases); total accommodation provided for 530 persons. With the bottom beds in the ward cars used for sitting-up cases the accommodation is increased to 638. The train is vestibuled throughout and fitted with electric light and fans; the exterior is painted khaki, with a Red Cross on each vehicle, and the interiors of all ward cars are enamelled throughout in white.

G.W.R. Company of Railway Troops, Royal Engineers.

SINCE the commencement of the war the Great Western, in common with other railway companies, have been asked to provide qualified railwaymen of various grades for special railway units of the Royal Engineers, and nearly 300 members of the staff have been nominated and enlisted in these troops. Recently, requests were received for a considerable body of men to form a constructional unit, and the proposal was made that the Great Western Railway should form a regimental company to consist entirely of Great Western employés. The authorities agreed to this, and sanctioned the formation of a Great Western company to consist of six officers and 242 men, a proviso being made that three of the officers should be nominated by the War Office. The following members of the engineer's staff have been granted commissions in the unit, and have been for some time at Longmoor preparing for the arrival of the men: Captain—Mr. R. C. G. Kirkpatrick, chief assistant to divisional engineer, Wolverhampton; Lieutenants—Mr. E. Lake, second assistant to divisional engineer, Plymouth; Mr. A. S. Quartermaine, assistant, chief engineer's office, Paddington.

On June 18th the first draft of fifty men was mustered in the general meeting-room at Paddington station preparatory to proceeding to Longmoor. Viscount Churchill, G.C.V.O., Chairman of the Great Western Railway Company, said he was very pleased to have the opportunity of saying a word or two to them before they left. He thanked them for their patriotic response to the invitation to place their services at the disposal of the country, and had every confidence that in the particular manner in which they were to be employed they would give a good account of themselves and reflect credit upon the railway from which they came. It was not given to all to be able to serve in any capacity in the theatre of war, and those who had the opportunity to bring the practical skill and knowledge to bear upon the situation where hostilities had been or were proceeding were in many respects to be envied as well as applauded and encouraged. He wished them all the best of good fortune and a safe and speedy return.

The general manager also expressed on behalf of the officers and staff of the Company the best of good wishes for the contingent. The men then formed up on the departure road, and headed by a Highland band, marched to Scotland Yard for enlistment—en route to Longmoor. On June 22nd a second draft of fifty men was dispatched.

Royal Engineers—Railway Troops—115th Company, London and North Western Ry.

THIS company has been formed of employés of the Engineering Department of the London and North Western Railway, comprising five officers and 242 men. The men have been sent off from Euston in five batches of about 50 each. Before leaving they were addressed by Mr. E. C. Trench, the Chief Engineer, who expressed his pleasure at the way the company's employés had volunteered for service with His Majesty's Forces, and hoped that they would quit themselves well in any duty they might be called upon to perform, trusting they would all have a safe return. He told them that the company would look after their dependents while they were away, and find them employment on their return. The officers of the company are Mr. W. E. Thornhill, Divisional Engineer, Crewe (Captain), and Messrs. F. G. T. Adams, G. F. Trench, S. O. Cotton, and W. H. Gyles (Lieutenants).

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A North Eastern Railway "Roll of Honour."

An object of special interest at North Eastern Railway stations is a sheet containing the names of North Eastern men who have laid down their lives for King and Country. This Roll of Honour contains so far seventy-one names, covering deaths which occurred prior to May 1st. Other names will be added in subsequent editions. At the principal stations the sheet is accompanied by a desk to which is attached a book containing lists under the headings of (1) the "Roll of Honour," showing the names of those who have laid down their lives for King and Country; (2) decorations and distinctions gained on Naval and Military service; (3) a list of those who hold His Majesty's Commission in the Navy or Army; and (4) a complete list of all the Company's employés who have joined His Majesty's forces. At other stations the book is hung by the side of the board; while at the small country stations a specially-worded poster informs the public that the book may be inspected on application to the stationmaster. The total staff employed by the North Eastern Railway numbers 54,000, of whom 7,000, or 13 per cent., have already joined His Majesty's Forces. At the conclusion of the War it is the intention to re-issue the book, so that the records which it contains may be complete in every way. This edition will also contain a list (which it is not at present possible to compile) of those who hold the rank of Warrant or Petty Officer in the Navy, or of Warrant or Non-Commissioned Officer in the Army.

THE FIRST CONTINGENT OF THE GREAT WESTERN RAILWAY REGIMENTAL COMPANY OF RAILWAY TROOPS R.E., LEAVING PADDINGTON STATION.

Traffic Working under War Conditions.

The demands made upon the time, strength, and energies of the staff of our railways in coping with the unprecedented requirements of the nation is shown by particulars of special work performed by London and South Western railwaymen, as recorded in the *South Western Railway Magazine*. In the vicinity of a military camp (Borden), during the month of April, in addition to the ordinary traffic of the station, 1,000 trucks were dealt with for the military authorities, also 8,000 soldiers on furlough and 50 special troop trains. In May the entire 9th Division was dispatched to Southampton, and a few days later another large party was received from Shorncliffe in their places, this necessitating the use of more than 1,200 trucks for military traffic and 200 special troop trains. In addition to officers' leave and furlough of other regiments not attached to the 9th Division, and the ordinary traffic of the district, more than 10,000 parcels were dealt with for military requirements. About 1,600 furlough and 1,800 week-end tickets are usually issued, and when it is remembered that the station is the terminus of a single-line branch, and that every train that arrives has to be shunted and the engine reversed, it will give some slight idea of the conditions under which the work of the station has to be carried out and the difficulties to be contended with.

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Railways and the War Loan.

As was only to be expected, the War Loan has been well supported by railways, and besides taking up considerable holdings, as far as their capital liabilities would permit, they have offered every encouragement to members of the staff to subscribe, particularly in regard to the smaller amounts provided for under the Post Office arrangements. In many cases special offers are made to encourage the rank and file of the service to subscribe. The following examples give the substance of arrangements made by various railways :—

Great Central Railway. To facilitate subscriptions by the company's employés to the new four-and-a-half per cent. War Loan, and thus enable the smallest investor to acquire Government stock upon exactly the same terms as the capitalist, arrangements have been made whereby subscriptions can be dealt with through the paybills. Upon the subscriptions reaching £5, or multiples of £5, arrangements will, if desired, be made for the conversion of these into War Loan stock and the issue of the necessary stock certificate.

Great Northern Railway. The Directors have applied for £100,000 of the Loan, and Mr. C. L. Edwards, Chief Accountant of the Great Northern Company, under date July 5th, issued a leaflet to the staff stating that the Directors have approved facilities being granted to enable all employés of the Great Northern Railway to subscribe to and purchase a share in the National War Loan. With this object, a form of application has been provided for such subscriptions to be deducted through the channel of the weekly paybills. To enable the staff to secure a £5 bond which will be inscribed in the name of the purchaser, before December 15th next, deductions of 5s. per week for twenty weeks commencing with week ending July 17th, are necessary. Deductions of smaller amounts, viz. : 1s., 2s., 3s., or 4s. per week, can be made if the applicant will state on the application form whether scrip vouchers to the lesser total value than £5 are required or whether it is intended to purchase a £5 bond. In the event of an employé wishing to purchase a £5 bond and not having subscribed the full payment by the week ending December 11th, 1915, the Company will secure the necessary bond in his name and advance the necessary balance to complete the purchase ; the bond will be delivered to applicant upon completion of the full subscription. Scrip vouchers will be purchased monthly for each applicant whenever the total sum deducted amounts to 5s., 10s., or £1.

Great Western Railway. The Great Western Railway Company have issued a circular to the staff at large stations to the effect that the company have been requested by the Government to provide facilities whereby their employés who desire to do so may invest in the National War Loan. As a temporary measure arrangements will be made whereby the staff at the larger stations will be afforded an opportunity of purchasing War Loan vouchers of 5s. or multiples of that sum.

London and North Western Railway. A circular has been issued to the effect that to assist the company's employés to obtain the new four-and-a-half per cent. War Loan upon the most favourable terms the company will immediately purchase sufficient stock to secure the discount of 8d. for each £5 of stock, and the full half-year's interest of 4½ per cent. due on December 1st, 1915, and arrangements have been made whereby subscriptions from the staff may be dealt with through the paybills. When the subscriptions amount to £4 19s. 4d. (*i.e.*, £5 less 8d. discount) or multiples of £4 19s. 4d., the necessary stock certificate will be issued to the applicant. The company will pay over to the subscriber the full 4½ per cent. interest on each £5 stock due on December 1st, 1915, and there will be no deduction for interest on the amount which the company will advance for the immediate purchase of the stock. To secure this the staff must authorise the company to deduct from their wages 2s. 6d. per week (5s. per fortnight from salaries) in respect of each £5 stock they desire to take up.

London and South Western Railway. In bringing the new War Loan under the notice of its staff, and to enable the small investor to subscribe to the Loan, the London and South Western Railway has made arrangements whereby employés who wish to subscribe to the Loan can do so by means of deductions from their wages through the paybills. A form has been issued to the staff for recording applications, empowering the company to purchase, on their behalf, Certificates of the War Loan Stock in amounts of £5 each, and for deductions to be made from their wages in sums of two or more shillings per week for each £5 Stock Certificate so purchased, the first deduction to be made for the week ending Wednesday, August 11th, 1915. The company has purchased sufficient £5 Stock Certificates in the names of trustees, and these are held until the full amount of £5 for each stock certificate has been subscribed, when the certificate will be transferred into the name of the applicant. Interest will be allowed by the company upon weekly instalments at the rate of 5 per cent. per annum in respect of the period during which interest is paid to them by the Government.

Midland Great Western Railway of Ireland. Arrangements have been made by the paymaster to deduct from the wages of any employé, who so wishes, a sum not less than 1s. per week, which the company will hold, and when sufficient has been subscribed will purchase for him one of these War Loan vouchers.

The Underground Electric Railways of London, Ltd., have subscribed themselves very

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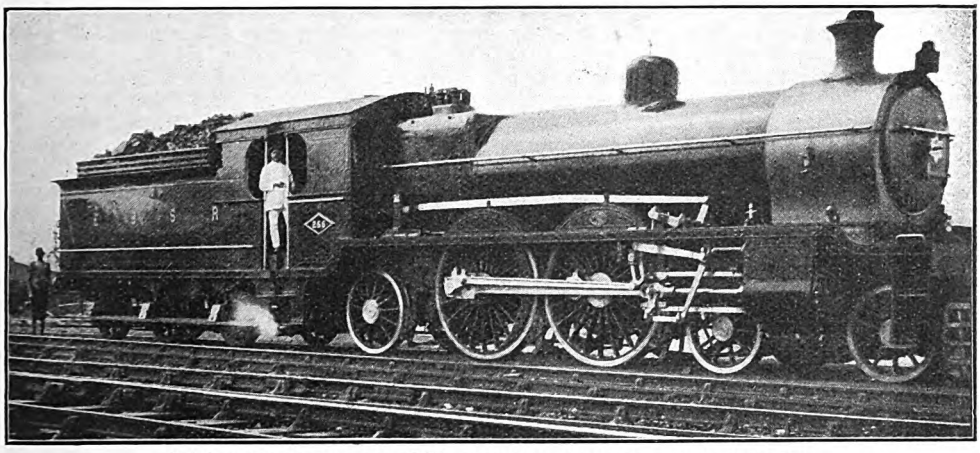
liberally, and in addition have issued a T.O.T. Loan Catechism, explaining the whole matter and intimating that the T.O.T. Companies are prepared to accept subscriptions of 2s. weekly, and upwards, and convert them into War Loan stock in due course. If need be, the company will always take back such vouchers at the price paid for them. A form has to be signed authorising the company to reserve the amount out of the weekly wages, or otherwise as may be arranged.

These or similar arrangements apply to most other railways. The National Union of Railwaymen have invested £106,000 in the War Loan.

Running a Vice-Regal Train on the Eastern Bengal State Railway.

THE Rev. W. Henry Scotter, of Grange-over-Sands, sends a photograph taken by his son, Mr. H. H. G. Scotter, one of our regular subscribers for many years, showing a 4-4-2 locomotive of the Eastern Bengal State Railway, of which he was in charge as locomotive inspector when conveying H.E. The Viceroy from Calcutta to Sara Ghat to open the great Ganges Bridge, on March 4th. Engine No. 255, Class M, maintained an average speed of 55 miles per hour in both directions. Mr. H. H. G. Scotter went out to his present appointment from the London and South Western Railway Works at Eastleigh in September, 1913. Before then he was with the Furness Railway for seven years.



4-4-2 LOCOMOTIVE NO 255, EASTERN BENGAL STATE RAILWAY.

Reminiscences of a Veteran.

ALTHOUGH it is now a number of years since Mr. G. P. Neele, the "first" Superintendent of the Line, London and North Western Railway, retired from active service, his name is still well-known, and to those who have read his interesting book of "Reminiscences," published some years ago and are familiar with the notable events which characterised his term of office, an article published in the *L. & N. W. R. Gazette* offers a special appeal. Our contemporary points out that there have been only three officers bearing the title of "Superintendent of the Line" on the London and North Western Railway. Mr. Neele held the position for 33 years, from 1862 until 1895; Sir Robert Turnbull held it for 19 years, while Mr. L. W. Horne has only recently succeeded to the title. Mr. Neele was born in 1825, and commenced railway service in 1847 on the Eastern Counties Railway, first at Ely and then at Bishopsgate, subsequently going to Norwich on the absorption of the Norfolk Railway by the Eastern Counties Company. In 1849 he was selected to be Superintendent of the South Staffordshire Railway. He remained in that position, with headquarters at Walsall, till the line was taken over by the London and North Western Railway. Mr. Neele thus became in 1861 an officer of the London and North Western Railway as Passenger Superintendent of the Central District, with headquarters at New Street station, Birmingham. In 1862 he came to London to inaugurate the new position of General Superintendent of the Line.

Mr. Neele has much to tell concerning the methods of early years, of the gradual substitution of luggage compartments for the older modes of roofing luggage, the provision of lavatory accommodation for long journeys, of the extension of the block telegraph system throughout the length of the line, and the adoption of raised signal boxes in connection. The interests of the Company at the Railway Clearing House meetings of the Passenger Superintendents were in his hands throughout his official life at Euston, and he was elected Chairman of the Conferences for the year 1868, and again for 1884. In 1881 Mr. Neele was selected as a skilled railway official to accompany the Directors of the London and North Western Railway on their special tour of inspection and observation of railway working and organisation in the United States and in Canada. Of the

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railway representatives who made this excursion to the States, Mr. Neele is now the only survivor.

Any reference to the incidents of Mr. Neele's railway career would be incomplete without alluding to the distinguished duty that so often fell to his lot of accompanying Queen Victoria on her journeys between Windsor or Gosport and Ballater. On the occasion of completing his 100th journey with Royalty, Her Majesty presented him with a handsome chiming clock, with inscription, and before starting from Ballater on his last (112th) journey the Queen desired Mr. Neele to be brought into the Royal saloon, and Her Majesty personally expressed regret at his resignation, and presented him with an engraved copy of Tuxon's Painting of the Jubilee Gathering of the Royal Family at Windsor (1887), saying that, as he had had so much to do with the journeys of the Royal Family, she would wish him to have that memorial of them. Her Majesty kindly added her name afterwards, with note of its presentation to Mr. Neele, and as the further souvenir which she promised, sent him a very large silver oblong tray with inscription: "Presented to George P. Neele, Esq., by Queen Victoria, as a mark of appreciation of the personal care and attention that he has for so many years devoted to Her Majesty on her railway journeys to and from Scotland. June, 1895." In addition to these Royal testimonials, Mr. Neele also received a beautiful Monteith bowl, with lion-head handle rings, and crest and monogram on embossed tablets from the "Members of the Queen's Household," with 35 names attached, acknowledging much kindness received on many occasions when travelling in Her Majesty's train.

Twenty years have passed since Mr. Neele's resignation, but one of the most gratifying incidents in his life took place a short time back —gratifying to him and the members of his family—an intimation from Mr. Bowen Cooke, of Crewe, that engine No. 2520 (one of the "Prince of Wales" type) had received the name *G. P. Neele.* The letter was accompanied by a photo of the engine, and conveyed Mr. Cooke's kind regards, "hoping the 'new G. P. Neele' will try to emulate in its way the splendid work done by its prototype on the London and North Western Railway."

Retirement of Driver Button, London and North Western Railway.

Having completed more than fifty years' service, Mr. Button, one of the best known drivers on the London and North Western Railway, has left the footplate, though he may still look forward to years of well-earned retirement. He was born on June 1st, 1845, and entered the London and North Western service at Camden as a cleaner on July 5th, 1864, and was promoted to Fireman in 1866, when he worked on the through goods and express passenger trains. In February, 1872, he was promoted to Driver and was Night Goods Pilot. He usually had an engine of the McConnell type. He was afterwards put to act as Passenger Pilot with one of the McConnell "Bloomer" engines, No. 1199, *Caithness*, and from this work he passed on to regular goods working, running to Manchester, Liverpool, and Bushbury with a "McConnell" goods engine, and during the latter part of the time with a DX engine.

When the Notts Joint line was opened for traffic to Doncaster in 1879, Button was sent to learn the road to Newark and over the Great Northern line to Doncaster, and made a plan of the roads, sidings, and signals for his foreman. He worked the first goods train from Camden to Doncaster in September, 1880. Soon after this he was appointed to express passenger work. He was in charge at various periods of No. 2183, *Antelope*, a "Precedent"; No. 310, *Sarmatian*, an "Experiment" compound; No. 2063, *Huskisson*, a "Dreadnought" compound; and 1304, *Jeanie Deans*, the famous "Teutonic" compound. In conjunction with the late Driver Jesse Brown, he commenced working the 2 p.m. *ex*-Euston and the 7.32 p.m. *ex*-Crewe on January 1st, 1891, with No. 1304, and was on this work until August 6th, 1899, when the engine was withdrawn from this service. The two drivers were quite attached to this engine, and always spoke of it in a sort of affectionate way as "Jeanie." The corridor stock was introduced on the 2 p.m. *ex*-Euston on July 1st, 1893.

In August, 1899, he was working engine No. 1911, *Centurion*, a Jubilee type, afterwards engine No. 1941, *Albemarle*, one of the "Alfred the Great" class, and following this he had engine No. 1958, *Royal Oak*, a "Benbow." On the introduction of Mr. Whale's "Precursor" engines, he was given No. 659, *Dreadnought*, and worked the 12.10 p.m. *ex*-Euston to Crewe, and when the "Experiment" type of engines were built, he had one of these, No. 1987, *Glendower*, and worked between Euston and Crewe. In May, 1911, he took charge of engine 1294, *F. S. P. Wolferstan*, in conjunction with Driver Peter Jarvis. This engine was one of Mr. Cooke's first superheaters, and the two drivers did some very good work with it on the 12.10 p.m. Euston to Crewe and return. From May to December, 1911, average loading of the train was heavy, 370 tons, and yet the consumption of the coal was low, and whilst only two minutes were lost on a very rough day in November with the 12.10 p.m. *ex*-Euston with a load of 410 tons, the time gained in the same period amounted to 861 minutes. The engine ran for eighty consecutive days without any special attention, and was doing so well just at this time that Button, in a jocular way, said he was going to ask Mr. Cooke to change the name of it to "Charley's Aunt."

On July 10th, 1913, he was sent to Crewe to bring engine 1191, *Sir Frank Ree*, one of the Claughton type, and, again in partnership with Driver Peter Jarvis, he worked the 12.10 p.m. *ex*-Euston to Crewe and the 5.2 p.m. return. He was working on this at the time of retirement. When working 1191, Mr. Cooke kindly allowed the two drivers, Button and Jarvis, and their firemen, to be photographed with the engine, and as it was rather unique for an engine to be named after an official still on the active list,

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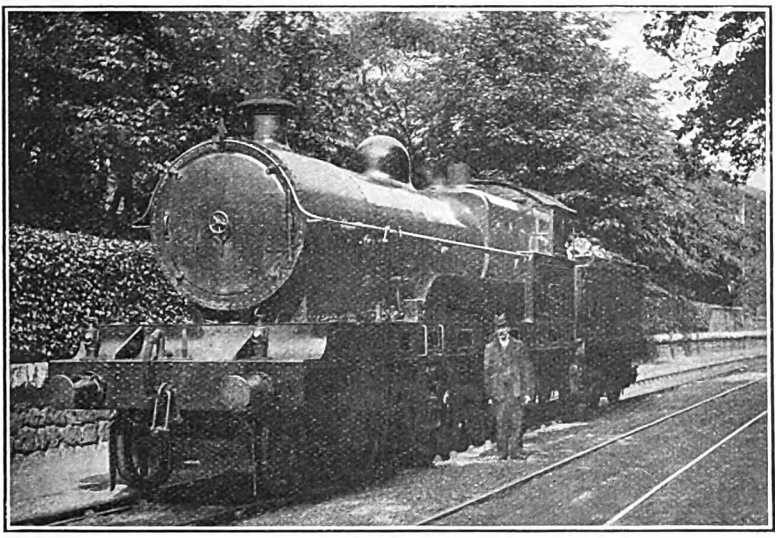
Sir Frank Ree kindly consented to accept a copy of the photograph. Unfortunately, his death took place while it was in preparation, and it was handed to Lady Ree.

During his long service, including many years when he was working the most important expresses, Driver Button never had an accident, nor was he ever in a collision. When Great Northern engine No. 1444, was tried on the London and North Western Railway, Driver Button acted as "pilotman" for the visiting driver, and he did the same in the case of Great Western engine No. 4005, *Polar Star*, in 1910. We are indebted to the *L. & N. W. R. Gazette* for these particulars of Driver Button's career, and for the illustration showing him standing alongside his last engine, No. 1191, *Sir Frank Ree.*

Fifty Years Ago.

Mr. L. B. Hewitt, an old-standing reader, sends two extracts from journals published fifty years ago, which read interestingly in view of the developments which time has since produced. Writing in the *Pall Mall Gazette*, dated June 15th, 1865, a correspondent who signed himself "A Juryman," stated that "whenever he was again called to award damages to sufferers by railway accidents, he was determined to award double damages when the accident had occurred through running an excursion train. The number of officials on any line, he contended, was only sufficient for the ordinary traffic, and the classes who were tempted to travel by the low prices of excursion trains were unused to railway customs and difficult to manage. The running of excursion trains was therefore attended by risks which the directors incurred with their eyes open, and for which they should be held responsible." Two serious accidents had then recently occurred, one at Rednal, on the Shrewsbury and Chester section, Great Western Railway, when seven persons were killed and 40 injured, the other being the Staplehurst accident on the South Eastern Railway: hence this letter, though it is not quite clear as to why "A Juryman" objected to excursion passengers, unless he considered that catering for them constituted a dangerous factor, justifying drastic action before an accident occurred—possibly due to the conveyance of "cheap" passengers!

The other extract is from the *Bath Chronicle* of July 13th, 1865, as follows:—"In consequence of the heat last week, the saloon carriage in which Her Majesty came to town to visit the Queen of the Netherlands had to be cooled with ice, which was strewn over the roof of her carriage previous to her return to Windsor."



DRIVER BUTTON AND HIS LAST ENGINE, NO. 1191, *Sir Frank Ree.*
Photographed outside the Chief Mechanical Engineer's Offices at Crewe.

Great Northern 8-ft. Singles.

Referring to Mr. Ahrons' articles dealing with now disappearing classes of Great Northern Railway locomotives, and particularly that famous and favourite class, the 8-ft. singles, a reader amplifies remarks concerning the preservation of the "shell" of No. 1 by pointing out that it was shown in 1909 at a "White City" Exhibition, alongside No. 1442, a large "Atlantic," a wooden staging being then erected connecting the footplates of the two engines enabling the public to pass from one to the other. At the close of the exhibition No. 1 was taken to the King's Cross locomotive depôt, where, it is understood, she still remains, while No. 1442 went into regular service.

Another reader, commenting upon the few

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8-footers still or recently in service, mentions that No. 1003 has disappeared, and is presumably scrapped; No. 1004 is serving as a stationary engine at Peterborough Shell Stores, while the last he saw of No. 1006 was in April of this year, when it was working the 7.25 p.m. Peterborough–Leicester train. Our correspondent considers that Mr. Ahrons and readers generally will be interested in these particulars of the last of the "Joy-Wheels" (as he states the drivers termed them).

Locomotive Train Working in the latter part of the 19th Century: L. & N.W.R. 3-cylinder Compound Engines.

SEVERAL correspondents having written Mr. Ahrons in reference to "imperceptible slipping" of the "Dreadnought" and "Teutonic" class engines, Mr. Ahrons writes as follows:—

"On page 381 of the May issue of the RAILWAY MAGAZINE I wrote that in my opinion the 'Teutonic' class with 7 ft. wheels proved to be better engines than the almost similar 'Dreadnoughts' with 6 ft. 3 in. wheels, as the high and low pressure engines could work much better in unison than they could with the smaller wheels, and that imperceptible slipping, to which all locomotives are subject, would not produce such a bad effect. Some correspondents have written to me on this subject, and one has compared the American large Mallet engines with the Webb engines in stating that the Mallet engines do not suffer from a similar defect. This may be quite true, but the conditions are very different. The Mallet engines have six and eight wheels coupled together for each cylinder, and have a great weight resting upon the coupled wheels, so that although slipping may occasionally occur, the high-pressure and low-pressure engines are much better adapted for keeping in unison. The Webb engines, on the other hand, were, in a sense, double 'single driver' engines, and single engines are particularly liable to slip. If a single engine, or a four-coupled engine for that matter, be travelling at, say, 40 to 50 miles per hour, it will be found that the driving wheels have made more revolutions per mile than they ought mathematically to have done. The difference will depend upon the state of the rails, whether greasy or dry, and in the former condition there will be more imperceptible slipping than would be the case if the rails were dry. Another factor is the unequal wear of the tyres, and if one pair of wheels has its tyres worn down slightly more than the other, the diameters will be slightly different, and the angular velocities will not be the same. In a coupled engine the coupling-rod keeps the wheels in step; but if the wheels are uncoupled, as in Webb's engines, there is nothing to keep them in exact unison, for it is obvious that the high-pressure wheels could slip when the low-pressure wheels were rolling steadily, and thus throw the exact relative positions of the valves out of synchronism. It is, of course, the case that the steam 'receiver' between the two cylinders—as the large steam pipe connecting the high-pressure and the low-pressure cylinders was called—would offset the disadvantage to a large extent, but the elastic connection of a steam column between the cylinders could not produce the same effect as a rigid coupling-rod, and there will be periods when the receiver would tend to become choked with steam and so produce a back pressure on the high-pressure pistons and retard the engine. This difficulty was, I believe, found to be the case in the first four-cylinder compound, No. 701, of the Northern of France Railway, which had uncoupled wheels as in the Webb engines. In all the succeeding French compound engines the wheels were coupled. M. Edouard Sauvage, in a paper on 'French Locomotive Practice' (Proc. Inst. Mech. Engineers, June, 1900), made the following statement referring to the French compounds: 'As already said, the coupling-rod has been preserved for two driving axles. It has been found in France that the disturbing forces due to the reciprocating movement of the pistons . . . can be diminished by thus coupling the wheels; the machine runs more smoothly and wears the permanent way less. In addition to this, the coupled wheels are less prone to slip; in fact, with two independent axles, if one slips, the steam immediately acts with greater effort on the other, making it slip in its turn.'

"To return finally to the 'Teutonics' and the 'Dreadnoughts,' let us suppose the high-pressure driving wheels to slip a linear distance of 3 ft. in the case of each engine. It will be found that the 6 ft. 3 in. wheels have slipped through an angle of 55°, and the 7 ft. 1 in. wheels through a smaller angle of 48½°. If the trailing wheels do not slip for the moment, the positions of the high-pressure and low-pressure valves will be more 'out of step' in the former case than in the latter. Probably both high-pressure and low-pressure engines will slip but very rarely to an equal extent."

The Exhaust of London and North Western Railway Compounds.

ARISING from Mr. Ahrons' articles dealing with the three-cylinder Webb compound engines on the London and North Western Railway, and correspondence in reference thereto already published, H. G. C. writes: "Your correspondent, Mr. R. H. Coe, says he has no idea why the 'puffing' of a compound engine should make a different noise from that of a simple. The reason is, that in the case of the former, the steam, before its final discharge through the chimney, passes from the high-pressure to the low-pressure cylinder, where the pressure is, of course, greatly reduced; this expansion of the steam accounting for the much softer sound made by the exhaust. With further reference to the Webb compounds, the same writer states that 'despite their unsatisfactory reputation for starting, I recollect that *Greater Britain* climbed the incline out of New Street in admirable manner, whereas I have often seen one of the modern "Precursors" and even the six-coupled "Experiments" almost brought to a standstill

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on the stiff rise out of New Street.' This assertion, if borne out by examination of facts, will surely come as a surprise to most locomotive engineers; and though I am not, personally, in a position to contradict it, I would suggest that it would be interesting to know what were the weights of the different loads hauled by the respective engines; also the state of the rails, etc., on the occasions referred to, as, without such information to support it, any comparison of this kind must be quite valueless."

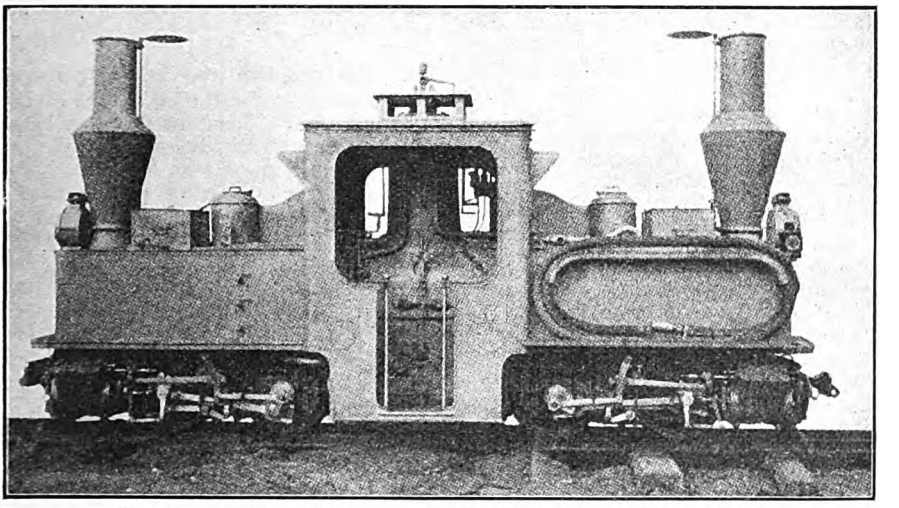
In regard to the first portion of "H. G. C.'s" letter, Mr. Ahrons remarks: "I find it very difficult to express an opinion. I have known some London and North Western and North Eastern compounds to make quite as much noise in exhausting as simple engines. Not only the compounding but also the size of the blast pipe affects the result, and also the volume of steam. Consequently, it is of no use theorising on the point, though, of course, it stands to reason that taking exhaust pressure alone into consideration, a compound should make less noise. It is, of course, impossible to state what happened or what were the conditions of the good start of *Greater Britain* from Birmingham. There is no reason why the engine should not have done so. Possibly on another day she might have done nothing like so well. I quite agree with the last paragraph of H. G. C.'s letter, and Mr. Coe's statement, without exact data, is not of any value."

Baldwin Locomotives for the French Government.

Some time ago we mentioned that the Baldwin Works, of Philadelphia, U.S.A., constructed in record time 100 articulated narrow-gauge locomotives for the French Government. As these are, presumably, for war service, detailed reference could not be made, but since particulars are now available from American journals received over here, they can be described. The illustration reproduced is taken from our American contemporary, *Railway and Locomotive Engineering*.

These engines are of the Péchot type, with 0-4-4-0 wheel arrangement, generally similar in construction to the Fairlie type, being carried on two steam trucks, while the boiler has two barrels and two fireboxes, the latter placed in a single outside shell, which is located between the bogies. Steam is normally admitted to all four cylinders; but, if desired, the locomotive can be operated by one bogie only. Live steam pipes leave the boiler through openings in the bottom, and pass down through the bogie centre pins, so that the ball joint in each pipe can be arranged to coincide with the centre on which the bogie swivels. Balanced slide valves, driven by Walschaert motion, are employed.

The cab is in the middle, and the water supply is carried in four tanks placed beside the boiler barrels. The tanks on the fireman's side are shorter, so that space is provided, adjacent to the cab, for coal bunkers. Each firebox has a side door, and is fired independently of the other. These locomotives were erected at the Eddystone plant of the Baldwin Locomotive Works, and were subjected to severe tests, each being run under steam for approximately half a day. A special track was built for testing purposes. Each locomotive was shipped complete in one case. The chimneys and a few small fittings were removed, but were boxed with the locomotive, so that very little erecting work was necessary on arrival at destination. Considering the fact that these locomotives were built throughout to metric measurements, and were of most unusual design, a quick record for delivery was made, as the order was received on February 1st, and the last engine shipped on April 24th.



0-4-4-0 ARTICULATED NARROW-GAUGE LOCOMOTIVE FOR FRANCE.

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The principal dimensions of these locomotives are :—Gauge, 600 mm. ; cylinders (four), 175 mm. by 240 mm. ; boiler—type, wagon-top ; diameter, 632 mm. ; working pressure, 12 kilogs. per cm. ; heating surface—firebox, 3.762 m. ; tubes, 23.225 m. ; grate area, .474 m. ; driving wheels—diameter, 650 mm. ; wheelbase—driving, 2.300 m. ; rigid, 0.900 m. ; total engine, 2.300 m. ; weight, on driving wheels, 12,790 kilogs. ; total engine, 12,790 kilogs.

The Frasne-Vallorbe Route to North Italy and the Mont d'Or Tunnel.

RECENTLY it was announced that the Paris Lyons and Mediterranean Railway had opened for traffic on May 16th the new Frasne-Vallorbe line, providing a shorter route for traffic between France and Northern Italy, and including the Mont d'Or Tunnel, 3¾ miles in length. The opening of this line avoids the detour *viâ* Pontarlier, thus shortening the journey by nearly 10 miles, and completing under most favourable conditions the international main line from Paris to Milan *viâ* the Simplon. The improvements carried out over this section have resulted in a gain of from forty-five minutes to one hour in the duration of the journey between Paris and Lausanne. Curves are favourable for speed, and in winter the tunnels and fir forests through which the line passes are a protection against snowstorms. The value of this new line is not confined entirely to the matter of distance. The Dijon-Lausanne line hitherto used, when crossing the Jura is only single line between Pontarlier and Vallorbe, and, moreover, runs through a district in which, during the winter, traffic is often rendered difficult owing to heavy snowstorms. Furthermore, the new line reaches a maximum height of 2,938 ft. only, as against 3,319 ft. on the old route, and being double track, with the heaviest grades of 1 in 66, instead of about 1 in 40, and adapted for heavy traffic, it is more suitable for inclusion in a main international traffic route. As a result of the opening of this line, the time between Paris and Milan *viâ* this route and the Simplon is now 14½ hours, for a distance of 508½ miles ; between London and Milan, 24 hours, 779½ miles ; between Paris and Rome, 27½ hours, 890½ miles ; between London and Rome, 40¾ hours, 1,161½ miles.

Branching from the existing Dijon-Pontarlier line at Frasne, the railway is carried across a peat bog area, spans the Drugeon River, and then pierces the Laveron ridge by means of three tunnels, the first of 1,020 yards, the second of 129 yards, and a third of 259 yards, before reaching Vaux station. After crossing the marshes of Vaux and Bonnavette the line enters a marshy stretch of flat land between the lakes of Saint Point and Remoray. Beyond Labergement, and after passing through a tunnel 573 yards long, it enters the picturesque gorges of the River Doubs. Les Longevilles station, at the summit, is almost at the French portal of the Mont d'Or Tunnel. This tunnel is 6,675 yards long and almost entirely in French territory. A new international station at Vallorbe is just beyond the Swiss portal of the tunnel. At this end connection is made with the Lausanne-Simplon line. The great tunnel is entirely on descending grade towards Switzerland.

Auto-Trains.

FURTHER correspondence shows that the articles under this heading in recent numbers have created a great deal of interest. Mr. L. Kelly, of Middlesbrough, now writes as follows : "With regard to 'Voyageur's' interesting article on 'Auto-trains,' it may interest him to know that in the Middlesbro' district, which he specially mentions, the introduction of auto-cars meant a saving of £700 annually in the locomotive accounts. This was, of course, largely due to the fact that at Guisboro' and the other reversing places mentioned, the lay-out was so awkward that more engines in steam had to be kept than there were trains. At first there was great prejudice here among the public against the auto-cars : due to ignorance of their working, no doubt."

The Midland Railway in Derbyshire.

REFERRING to Mr. Hallett's article on this subject published in the June RAILWAY MAGAZINE, Mr. A. Ranson Cowlisham writes as follows : "On page 463, paragraph two, line nine, Mr Hallett says, 'Beyond Whatstandwell the line passes under a canal, over the Derwent and through a short tunnel.' This, however, is not the case. The line passes under the canal (Midland property), through the tunnel (Lea Wood, 315 yards), and then over the Derwent ; or to be still more precise, it passes over the Derwent, under the canal, through the tunnel, under a branch of the canal, and over the river again. Another point, though here Mr. Hallett is not wrong exactly, is that he states in the same paragraph that *near* Cromford the High Peak mineral line joins the Midland. I have read several railway and guide books, which all say 'near Cromford.' It isn't near Cromford at all. It is near Whatstandwell. The distance from Cromford station to High Peak Junction is double the distance between High Peak Junction and Whatstandwell station."

A Proposed "Quadruplex" Locomotive.

IN our last issue we referred to the fact that in the course of a lecture given by Mr. G. R. Henderson, Consulting Engineer to the Baldwin Locomotive Works, a proposed "Quadruplex" design was referred to, and now, by the courtesy of that firm, we are able to reproduce a diagram of this exceptional design. It is true that it is only in the proposal stage, and it remains to be seen whether it will achieve realisation. At the same time, there is no reason to expect otherwise, although there may be modifications before it is translated into practice.

The design includes two pairs of high-pressure and two pairs of low-pressure cylinders, so that there are two cylinders for each set of eight-coupled wheels. The firebox is of special design,

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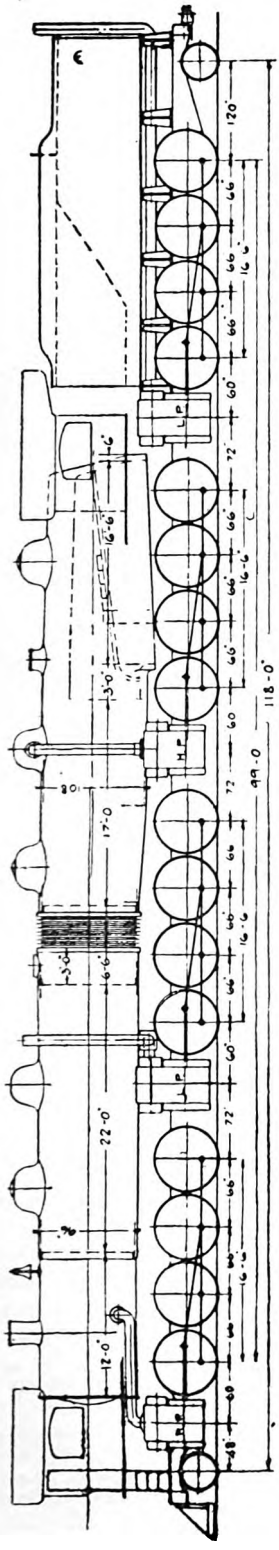

PROPOSED 8-CYLINDER, DOUBLE COMPOUND, 32-DRIVER "QUADRUPLEX" LOCOMOTIVE, WITH FLEXIBLE BOILER AND MANY SPECIAL FEATURES.

Designed by the Baldwin Locomotive Works, Philadelphia, U.S.A.

with combustion chamber, and as it must needs be, in view of its enormous length, is equipped with a Street mechanical stoker. The barrel proper, with a coned ring in front, is 17 ft. long from the back tube plate, and in front is virtually a second boiler, for 22 ft. tubes, the two sections being connected by an intermediate combustion chamber which is formed with an "accordion" joint, as was done for an engine on the Atchison, Topeka and Santa Fé Railroad a few years ago. Without such an arrangement so enormous a boiler length would be quite impossible, as a degree of flexibility is imperative.

Leading dimensions are as follows :—Gauge of road, 4 ft. 8½ in. ; working pressure, 215 lb. per sq. in. ; tractive power, 200,000 lb. ; cylinders, high-pressure, diam. 27, stroke 32 in. ; cylinders, low-pressure, diam. 41, stroke 32 in. ; drivers, diam., 60 in. ; firebox, type radial stays ; firebox, length 198, width 108 in. ; valve motion, Walschaert ; superheater type, Schmidt. Heating surface—firebox, 400 sq. ft. ; flues, front, 5,800 sq. ft. ; flues, back, 4,500 sq. ft. ; fire-arch tubes, 50 sq. ft. ; total, 10,750 sq. ft. ; grate area, 160 in. by 108 in., 120 sq. ft. ; superheater, 1,400 sq. ft. Weights in working order—truck, 35,000 lb. ; drivers, 800,000 lb. ; trailer, 50,000 lb. ; total engine, 885,000 lb. ; ratio of adhesion, 4. Tender—water capacity, 10,000 gals. ; fuel, 15 tons ; tank : weight loaded, 250,000 lb.

Railway Traffic Under War Conditions.

In reference to a remark made recently as to the variety of wagons often to be seen on goods trains under war conditions, Mr. Cowlisham writes : "In your paragraph on trucks getting on other railways (on page 485), it is rather a pity you missed the first half of the train, or you might have 'beaten' my number. A few weeks ago I saw a goods train from Woolwich pass through Blackheath (South Eastern and Chatham) about 11.30 p.m., with 17 different company's trucks, as follows : Midland, North Eastern, North British, London and North Western, Great Western, Great Central, Great Eastern, Great Northern, South Eastern and Chatham, London, Brighton and South Coast, London and South Western, Midland and South Western Junction, Cheshire Lines Committee, Lancashire and Yorkshire, Hull and Barnsley, Glasgow and South Western, and Furness."

Extensive Orders for Superheaters.

The "Robinson" Superheater for locomotive work is rapidly advancing in favour amongst railway engineers. Evidence of this fact is afforded by the extensive orders which have recently been placed with the Superheater Corporation, Ltd., who are engaged in the supply of the "Robinson" Superheater Apparatus, and are the sole owners of the patents under which it is constructed. The Corporation have recently been entrusted by the Indian State Railways with instructions to instal the "Robinson" Superheater on 41 locomotives for the North Western Railway of India. These

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locomotives are being built by the Vulcan Foundry, Ltd. Instructions have also been given by the Government of the Federated Malay States to fit the "Robinson" Superheater to ten locomotives which are being built by Kitson and Co., Ltd. Among other orders recently received by the Corporation are the following:—20 for the Commonwealth of Australia Railway. (Locomotives being built by Walker Bros., Ltd., Australia); 8 for the Commonwealth of Australia Railway. (Locomotives being built by the North British Locomotive Co., Ltd.); 3 for the Queensland Railway. (Locomotives being built at the Railway Company's Works in Australia); 20 for the Great Northern Railway. (Locomotives being built by Beyer, Peacock and Co., Ltd.); 15 for the North British Railway. (Locomotives being built by the North British Locomotive Co., Ltd.); and 5 for the Great Northern Railway of Ireland. (Locomotives being built by Nasmyth Williams and Co., Ltd.).

Khaki-clad Railway Enthusiasts.

EARLY in July the secretary of the Camps Library telephoned to the RAILWAY MAGAZINE office that there was a big demand for the magazine in the trenches in France, but not a copy was left in the Library at 22, Earl Street, Westminster. The publishers at once took steps to meet the deficiency, but since that date arrangements have been made by His Majesty's Postmaster General whereby RAILWAY MAGAZINE readers may assist in keeping railway enthusiasts in the fighting forces supplied with literature. If magazines are posted to individuals or units the usual charges must be paid, but on and from July 7th magazines not more than twelve months old and reasonably clean may be handed in at any post office for the use of British soldiers and sailors. The post office will send the magazines to a central depôt, whence they will be transferred to the Camps Library, the War Library, the Prisoners of War Help Committee, and other organisations approved by the War Office and Admiralty, who will undertake their distribution to the soldiers and sailors at home or abroad, in camp, at the front, in hospital, or detained as prisoners of war. Magazines intended for free delivery should not be addressed or packed and they must not be posted in a letter-box, but handed in over the counter at a post office. No acknowledgment can be sent donors but they can be quite sure their gifts will be put to the best use and will be warmly appreciated by the men whose leisure they will help to interest and occupy.

We are assured by the authorities that the demand for the RAILWAY MAGAZINE among naval and military men is a great and very real one and we appeal to our readers to assist in supplying the needs of our gallant fighting men. How much the magazines are welcomed in His Majesty's Forces is demonstrated by a letter received on July 13th by the Secretary of the Camps Library from a soldier who had particularly asked for them. He says:—"Many thanks are credited to you, sir, for the books which I received during the week, and I can assure you they have been a source of relief to us fellows, for they have helped to pass away many a tiresome hour. They are just the books we wanted and we have been keenly interested in them. Should you receive any more we should be very thankful for them, seeing that you have done your best to help us, I trust that you will do so again."

Railway Literature.

RAILWAY OPERATION: THE GOODS DEPOT. By J. A. Jenkinson, David R. Lamb and Charles Travis. Price 1s. net. (Post free from the offices of the RAILWAY MAGAZINE, 30, Fetter Lane, London, E.C., 1s. 3d.) The scope of this book—the second in the series of railway educational works, of which the author's "Elements of Railway Operating Economics" is already well-known and highly appreciated—is designed to cover the many phases of operation involved in the management and working of a goods terminal. No effort is made to treat any one subject too exhaustively, as this would necessitate the compilation of a volume far larger than the present one, but within the scope allowed a large fund of useful information is given. Various chapters deal with goods terminal organisation, inwards and outwards arrangements, general conditions of carriage, rates and classification, terminal services and charges, goods accounts and goods depôt administration.

HOME—BY UNDERGROUND OR MOTORBUS. Edited by G. A. Olley. Described as an Illustrated Guide to charming residential localities in districts served by the Underground Railways and their Allied Companies, and published under the auspices of the Underground Railways and their Allied Companies, by Walter Hill, 67, 69 and 71, Southampton Row, London, this useful guide deals with all growing and desirable residential districts to which access is given by the public transport services concerned. The book is well illustrated, and includes concise information as to residential characteristics of the various districts covered, with particulars of travelling arrangements, rates and facilities. Included is a register of properties, estate agents, builders, and leading tradesmen, etc. Copies are obtainable from the various Underground railways and at principal stations.

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At the fifty-seventh annual meeting of the Railway Benevolent Institution, Mr. A. Beasley, General Manager, Taff Vale Railway, presiding, the report stated that there has been a slight decrease in the contributions for the last year, though not so serious as was anticipated. Mr. Beasley expressed special pleasure in reference to one item, with which he had had something to do—the special appeal to railway shareholders. This produced £1,145, which is £400 or £500 more than the same item last year. Dealing with the Institution's sources of income, the Chairman pointed out that subscriptions from officers, who are members of the general funds of the Association, increased from £3,280 in 1899 to £4,518 last year, and during that period their membership increased by 5,603. Subscriptions from servants increased from £1,303 in 1899 to £6,143 in 1915, an increase of £4,840. In the same period the membership of the servants increased by 12,495. Referring to legacies received, Mr. Beasley added: "My very old and dear friend, Mr. William J. Noble, K.C., died and left the whole of his property to the Institution as residuary legatees. You will notice that it is mentioned in the report in this way: Mr. William James Noble, K.C. (son of the late Mr. John Noble, many years general manager of the Midland Railway Company), who died in November last, bequeathed all his property to the Institution. £5,473 has been received on account of this bequest, which will probably amount in all to about £8,000. Mr. Noble's father took a great interest in the Institution, and it is very gratifying to me to know that his son thought of the Institution when he disposed of his own property." During the year thirty-six widows in the officers' department were admitted annuitants; twenty-five members in the officers' department were elected annuitants; twenty-one children in the officers' department were elected to school benefits; twenty-one widows in the servants' department were admitted as annuitants; twenty-six members in the servants' department were elected annuitants; one orphan in the servants' department was admitted to school benefits. A vote of thanks to the Rt. Hon. Lord Balfour of Burleigh for presiding at the annual dinner on May 4th was passed, and his name was added to the list of patrons. The officials for the ensuing year were elected, and Mr. A. Beasley, General Manager, Taff Vale Railway, and Mr. E. Watkin, General Manager, Hull and Barnsley Railway, were elected members of the Board of Management.

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At the annual meeting of the Railway Servants' Orphanage, Mr. A. J. Grinling, Chief Traffic Manager, Great Northern Railway, in the chair, the report stated that the whole of the candidates eligible under the rules, ten girls and twenty-five boys, had been accepted for admission. Two of these were the children of a Midland Railway servant, who, as a reservist, was called up on mobilisation, and died as the result of exposure in the trenches. Twelve girls and thirty-one boys left upon reaching the maximum age, or had been withdrawn by their friends for satisfactory reasons. Suitable employment for those who left on account of age had been readily found, and they had all made a promising start in life. There were on the books, April 30th: 82 girls and 169 boys; total 251. In the examination for "minor" scholarships of the Derby Education Committee, William Griffiths came out top of the list in Derby, and was consequently awarded a scholarship at Derby School. George Parsons gained one at the Municipal Secondary School, and William R. J. Ford one at Hastings Street School. The report was duly adopted, Lord Claud Hamilton being re-elected treasurer. Lord Balfour of Burleigh, who was accompanied by Lady Balfour, subsequently presented the prizes to the children.

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On Friday, June 25th, the chief officers of the London Underground and Associated Railways gathered at the Savoy Hotel, for the purpose of joining in a farewell dinner to Mr. John W. Towle, the superintendent of power, prior to his departure for Barcelona, where he has accepted an important post. Sir Albert H. Stanley, Managing Director, presided. Mr. Z. E. Knapp, Manager for Maintenance and Construction, gave a history of the rise and progress of the power house under the superintendence of Mr. Towle. A silver tea urn and tray was presented to Mr. Towle on behalf of the managers and officers who had been associated with him. Mr. P. V. McMahon, hitherto in charge of the City and South London Railway, succeeds Mr. Towle in control at Lots Road.

* * *

Mr. J. M. Eddy, late Mineral Traffic Manager, London and North Western Railway, before leaving England to take up his new appointment

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as General Manager, Buenos Ayres Great Southern Railway, was entertained to lunch by his brother officers of the London and North Western Company at the Euston Hotel. The Chair was taken by Mr. Guy Calthrop, General Manager, who, in wishing Mr. Eddy good-bye, presented him with a silver tray subscribed by a number of his colleagues, and expressed the hope that he would meet with every success in connection with the new position he was about to take up. Mr. David Simson, Chairman of the Buenos Ayres Great Southern Railway, also spoke, and said he was glad to see that Mr. Eddy was having such a good send-off from his brother officers in the North Western.

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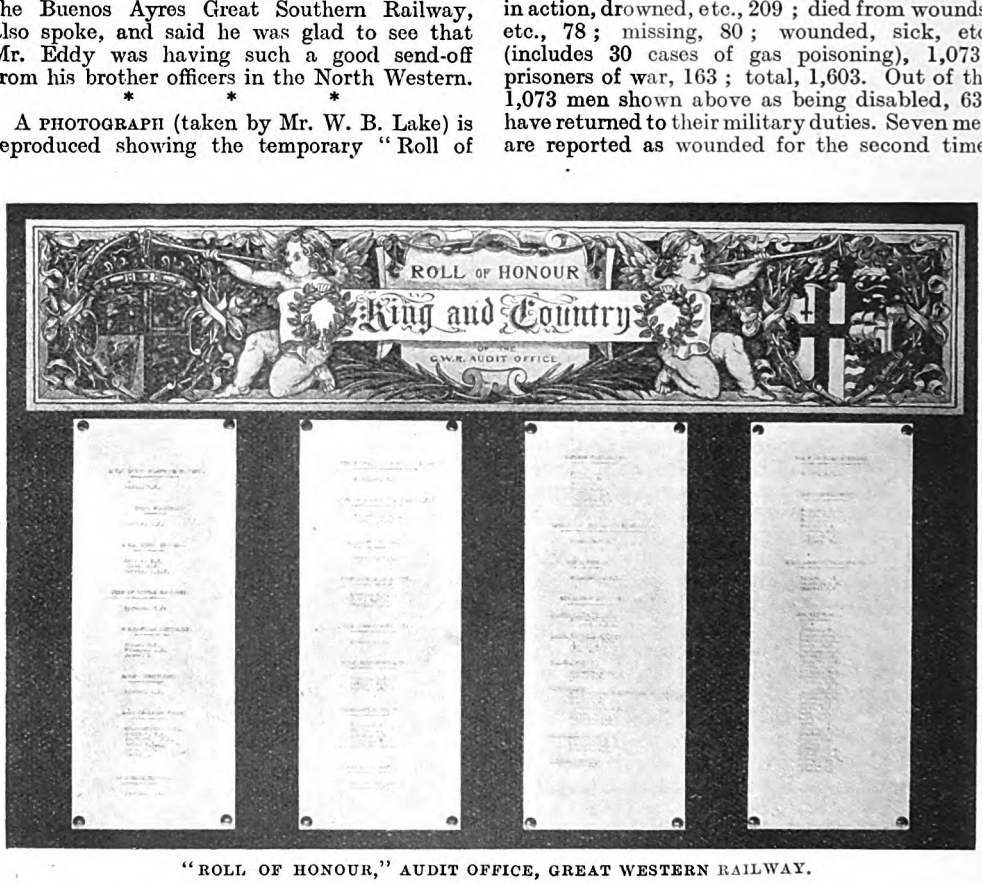
A PHOTOGRAPH (taken by Mr. W. B. Lake) is reproduced showing the temporary "Roll of Honour" which is hung in the Audit Office at Paddington, Great Western Railway. This office has sent 103 men to H.M. Forces, many of whom are now in the trenches, out of a total of 322. Three have already obtained Commission Rank. The decorative heading of the "Roll of Honour" is a unique piece of work, being specially designed and presented by Mr. J. Lisle, of Ealing. The figures represent love calling upon the men to serve their country; with the Royal Arms on the left and the Company's Arms on the right, the whole being well balanced. The cherubs are holding crowns of laurel leaves, "The Victor's Crown." This was specially drawn because of the death of J. Chamberlain, killed at Hill 60. This is only the temporary roll, the office aspires to something more beautiful as a permanent "Roll of Honour."



"ROLL OF HONOUR," AUDIT OFFICE, GREAT WESTERN RAILWAY.

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As showing the inroads made by the war upon the staffs of the large railway companies, which have supplied thousands of men to His Majesty's Forces on land and sea, the total casualties reported amongst London and North Western men up to date may be referred to. They amount to 1,603, made up as follows:—Killed in action, drowned, etc., 209; died from wounds, etc., 78; missing, 80; wounded, sick, etc. (includes 30 cases of gas poisoning), 1,073; prisoners of war, 163; total, 1,603. Out of the 1,073 men shown above as being disabled, 630 have returned to their military duties. Seven men are reported as wounded for the second time, while C. E. Barratt, formerly a porter at Watford, is reported as wounded a third time.

* * *

NEW time-tables introduced by the Great Eastern Railway, to take effect from July 12th, are remodelled in several important respects. All pages face the same way, reading from the longer side, and headings are given in bold type on all outer margins, being in fact placed below the tables where that position is most advantageous. Many of the tables are now given in sectional form, thus avoiding many of the usually inevitable confusing factors, but a complete system of marginal references renders it easy to follow out a desired journey. Several

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good trains are now given, though of course none of the special summer facilities could be expected. However, the traveller must be considered to be very generously treated, in view of the conditions, with the 5, 8.30 and 10.15, and 11.42 a.m. and 12.30 (Saturdays only), 1 (Saturdays only), 3.10, 3.22, 4.55, 5.23 and 7.45 p.m. down expresses on the Colchester line, and the 5.13, 8.40, 10.30 (St. Pancras), 11.15 (Saturdays only) a.m., 12 noon, 2.35, 3.55 (St. Pancras), 4.20, 4.50, 5.13, 5.52, 7.2 and 8.58 p.m. as expresses for Cambridge and beyond, with return services, and including restaurant car services on a large proportion of the Colchester line principal trains, besides one or two on the Cambridge line, and with the more important Clacton-on-Sea, Southend and other special facilities also available.

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TRAVELLERS going in and out of Temple Meads station, Bristol, and those regularly attending the adjoining cattle market, have been interested in the progress of the new buildings which are a first step towards what will be practically a new market. For the third time since the market was first opened in February, 1830, the area is to be reduced for railway station purposes. First the Bristol and Exeter Railway Company took a slice for their station, and then, in the early 'seventies of last century, the £300,000 Joint station took another slice, the railway companies spending nearly £10,000 on a reconstruction of the market, which still afforded accommodation for nearly 10,000 animals. In due time Bristol will have both a better market and a greatly improved and more convenient station.

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Now that the Continent is virtually closed to those who desire rest and change of scene, many people there are who for the first time are making practical acquaintance with the advantages Great Britain has to offer the health and holiday seeker. To assist all and sundry in finding a suitable centre for a real health-giving holiday in the homeland the "Great Central Railway's 1915 Guide to Health and Holiday Resorts" provides a veritable mine of choicely illustrated information. The descriptive matter has been entirely re-written and, as in all publicity literature issued by the Great Central Railway, a very high standard of literary and artistic merit has been achieved. The scope of the book is not confined to the immediate territory served by the Great Central Railway for the holiday haunts described are to be found in East Anglia, Yorkshire, Wales, Devon and Cornwall, to say nothing of inland resorts such as Cheltenham and Bath. From the Publicity Department, 216, Marylebone Road, London, N.W., information, booklets, etc., will be freely supplied to all intending holiday makers and tourists.

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THE resignation of Mr. Helliwell from the position of Passenger Agent at Exchange station, Liverpool, Lancashire and Yorkshire Railway, has been followed by the creation of a dual post. Mr. W. H. Bentley, who was Chief Assistant to Mr. Helliwell, is now Passenger Agent, and Mr. Walter Hayes, Parcels Agent. Both have had a long connection with the Lancashire and Yorkshire Railway. Mr. Bentley started as a Telegraph Clerk at Blackburn station forty-three years ago. From various roadside stations he moved to Bolton, and then becoming General Passenger Clerk, worked in turn at Moses Gate and Pendleton, until promoted to Victoria station, Manchester, and Southport, finally becoming Chief Assistant to Mr. Helliwell at Exchange station. Mr. Hayes started as a messenger at Hindley. He went through the booking and parcels department there, also at Southport and Lowmoor, and was a considerable period in the head office of the Company at Manchester. He came to Liverpool in 1912 as Chief Parcels Clerk.

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GREAT Western Railway Time Tables, which came into use July 12th, will operate until further notice, the intention being that they shall remain in force throughout the winter, or until a change in the present situation takes place. The summer trains have been specially marked, to show the period for which they will be run. In framing the new time table, it has been necessary to consider, first, the effect of the war conditions upon holiday and tourist travel; and secondly, the resources of the Company (in men and engine power) available for the passenger service beyond that which must be devoted to Government requirements. The modified train service which has, of necessity, been adopted during the winter and spring months, forms the basis of the new time tables, with a limited number of extra trains for summer traffic. Although holiday traffic will be less than usual, it is probable that the West of England will be specially favoured; and amongst the additional trains run are the 11.10 a.m. summer express, Paddington to Penzance, and the 11 a.m. from Penzance to Paddington. It is also anticipated there will be a good traffic to West and North Wales; and the services to the Weymouth, Minehead, Ilfracombe, Aberystwyth, and Barmouth districts have been strengthened for a short summer period.

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WE regret to record the death, on June 28th, of Mr. Charles Ernest Paola Della Diana Spagnoletti, at the age of eighty-two years. He was born at Brompton July 12th, 1832. After some months in the actuaries' department at the National Debt Office, in 1846 he commenced as a student under Mr. Alexander Bains, who was then working upon chemical printing telegraphs and electrical clocks. In 1847 Mr. Spagnoletti was transferred to the Electric Telegraph Company in Founder's Court, which purchased Bains' patents. In 1855 he, being engaged for the Electric Company on Great Western Railway work, entered that railway company's service as the first railway electrical superintendent. In 1889 he was appointed as

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consulting electrical engineer to the first electric tube railway — the City and South London. In 1892 he retired from railway service owing to severe illness. His inventions include a disc-block telegraph instrument for one, two, or three wires, used on the Metropolitan, the District, the Great Western, and other railways; an interlocking system of mechanical signals largely adopted; an induction coil for needle instruments to obviate the dangerous effects of lightning; a signal repeater and a tell-tale lamp; a portable telegraph for Queen Victoria's railway journeys, and many other devices for various purposes. He also developed and improved the Phonopore telephone; constructed many lines of telegraphs, amongst which were the systems of the Metropolitan Railway (1863) and District Railways, maintaining them both for many years. He also installed the electric lighting of those companies' joint line stations, and of the Mansion House and Whitechapel stations. His pioneer experience was most valuable, especially so on behalf of railway companies, in the purchase of the telegraphs by the State, and in the compilation of the rules and instructions for the general working of the electrical department of the Great Western Railway, such rules and instruction also subsequently forming the basis of those which, with few exceptions, were adopted at home and by many railways abroad, who soon followed the Great Western Company's example of forming their own electrical departments.

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THE Italian State Railways have opened a London Office at 12, Waterloo Place, Regent Street, S.W. Arrangements are here made for the issue of direct and circular tickets from this country to places in Italy and to the Italian frontier stations, also of local tickets (including tour and season tickets) on the entire system of the Italian State Railways. This office also represents in the United Kingdom the following steamship companies:—The Italian Government Lines, the Servisi Marittimi and the Navigatione Generale Italiana, Italia, La Veloce and Lloyd Italiano Steamship Companies. Complete arrangements can be made at these offices for journeys to Italy and by the above mentioned steamship services. Illustrated booklets of the chief towns and districts in Italy will also be issued, while publications of the Touring Club Italiano (Guides, Motoring Maps, etc.) are available for purchase or consultation. There is also a library of books on Italy by the best English and foreign authors, also Italian Government publications may be consulted. Books on any subject concerning Italy will be recommended, and a comprehensive selection of photographs and views of resorts, places and objects of interest in Italy will be available for inspection or purchase. A distinct convenience to travellers and others is afforded by the Branch of the Banca Commerciale Italiana installed in the same premises, through which every description of banking business may be transacted, including exchange of money (all currencies) issue of Letters of Credit, Circular Notes, Current Accounts, etc.

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WE have before referred to the appointment of the Hon. B. Eastwood, Chief Accountant and Acting General Manager, Uganda Railway, to be General Manager, in succession to Mr. H. Blake Taylor, M.I.C.E., F.C.H., resigned, and we now reproduce a portrait of Mr. Eastwood. The appointment is one of great importance, as in addition to the parent line of the Uganda Railway, which runs from Mombasa to Lake Victoria, there are also branch and subsidiary lines in both East Africa and Uganda, and steamer services on Lakes Victoria and Chioga. Schemes of extension are either in hand or under

THE HON. B. EASTWOOD,
Chief Accountant and Acting General Manager, Uganda Railway.

consideration that will make a great difference to the prosperity of the country. The appointment carries with it, *ex-officio*, a seat on the legislative council of British East Africa, and Mr. Eastwood at the present time also holds the high position of a member of the executive council of the Protectorate. Mr. Eastwood began his business life on the Fleetwood Dock Works in 1877, which were being carried out by the well-known firm of John Aird & Sons, and left that firm to join the staff of the Uganda Railway in 1897, in the very early days of its construction. He has helped it to grow to what it is to-day, the commercial backbone of the East African Protectorate.

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THE D.C.M. has been awarded to Lance-Corporal H. D. Peabody, of 9th County of London Battalion, Queen Victoria's Rifles (T.F.), Clerk, Chief Accountant's Office, Euston, London

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and North Western Railway. The official announcement by the War Office is as follows :—"Awarded the D.C.M. for the great gallantry and endurance displayed, and for the excellent service rendered in the fight for the possession of 'Hill 60.'"

* * *

MR. L. A. DINWIDDY, formerly a porter at Exeter St. Thomas' station, Great Western Railway, who is attached to the 3rd Battalion, Coldstream Guards, has been awarded the Distinguished Conduct Medal for conspicuous gallantry at Givenchy, in assisting to rescue officers and men from a deep mine full of poison gas.

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"COUNTRY HOMES IN METRO-LAND" is the title of a new booklet issued by the Metropolitan Railway. As a guide to those desirous of information as to suitable residential localities this may be commended, especially in view of the growing favour of the beautiful districts rendered accessible by Metropolitan trains. A number of coloured illustrations are included, also others in half-tone, while there is a careful selection of data concerning matters which interest the prospective householder. Copies can be had at stations, or direct from the Commercial Manager at Baker Street station.

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A REMARKABLE picture of the "Cornish Riviera Express," hand-painted in exact colours in every detail, is at present exhibited in the window of the International Sleeping Car Company's Office, Cockspur Street, London, W. The original, 7 ft. 1 in. base by 1 ft. 8 in. deep, is unique, in so far as it is from an actual photograph showing the complete train broadside on, thus giving a striking impression of its magnitude and the extent of its accommodation. The down train is shown, consisting of 12 coaches, the engine being *Queen Boadicea*, 4-6-0 (4-cylinder) "Star" class. The train, including the engine, is 914 ft. long, and seating accommodation is provided for 576 passengers.

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COUNCILLOR F. P. ROBJENT, Mayor of Newport, who is to be the new Chairman of the Newport Harbour Board, was born at Clifton in 1859, came to Newport in 1883, and since 1894, when his partnership with the late Mr. C. E. Parsons was dissolved, has carried on independently the profession of stockbroker. Since 1902 he has been a member of Newport Town Council, and is Mayor of Newport for 1914–15; thrice has he been President of the Chamber of Commerce; he is a Justice of the Peace for Monmouthshire; Chairman of the Mold and Denbigh Railway Company, Chairman of the Colonial Property and Rubber Company, a Director of the Festiniog Railway Company, and a Director of the Kurunegala Rubber Company. He has been for some years Chairman of the Finance Committee of the Newport Corporation.

Two more of Mr. Robinson's new goods tank engines, Nos. 275 and 276, have been completed. A large number of Great Central engines have been fitted with the Robinson superheater. No. 145, which has been superheated, is also fitted with a special type of Wakefield lubricator. The deliveries from the pump are at the side of the lubricator instead of the bottom, the working parts are more accessible than in the earlier pattern. It is a four-feed lubricator, delivering oil to the steam chest only at the back and front, the cylinders being lubricated in a similar manner to the non-superheated engines. No. 357 has been fitted with a new type of sanding arrangement, the sides of the shoes being made of rubber in place of wrought iron plate, so as to allow the engine to go over points and crossings without breaking the shoes, the rubber sides giving should these strike the crossings or any other obstruction.

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THE Hull and Barnsley and Great Central Joint line between Gowdall and Braithwell, 22 miles in length, sanctioned in 1909 and commenced in 1911, is nearing the completion stage. It will open out an undeveloped coalfield lying to the east of the York and Doncaster main line. A Scherzer rolling-lift bridge is being erected over the Aire and Calder Canal. The line was originally promoted by the Hull and Barnsley Railway Company, with the support of the Midland Railway, to whom running powers were to be given, and who were to find part of the capital. Later the North Eastern Railway Company also obtained running powers and other advantages, while opposition by the Great Central Railway resulted in the new line being vested in the Hull and Barnsley and Great Central Companies. The Act was obtained in 1909, contracts were let the following year, and the work of construction commenced in 1911.

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IMPROVEMENT works in connection with Woodhead tunnel, Great Central Railway, are now virtually completed. The object has been to improve the ventilation of the tunnel, and work was commenced about three years ago. There are five shafts for ventilation along the two single line tunnels, the depths varying from 134 to 188 yards, and they are about 8 ft. in diameter, being practically unlined, openings being cut from the two tunnels to communicate with the shafts. No. 2 shaft has been divided to a diameter of 16 ft., lined with bricks. Shields were placed in both tunnels to protect trains while the work was in progress. At the foot of the shaft, some 40 ft. above rail level, a special chamber has been constructed which connects the shafts to the two tunnels.

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LORD EDMUND TALBOT, having, as a member of the Coalition Government, resigned from the position of Chairman of the Cardiff Railway Board, the Marquis of Bute has been elected Chairman in his place. The Marquis of Bute who has an enormous financial interest in the

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Bute Docks, thus succeeds to a position which for many years was held by his father and grandfather.

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THE Canadian Government Railways took over, on May 1st, the operation of the National Transcontinental Railway from Moncton, N.B., to Winnipeg, and the Grand Trunk Pacific Railway's Lake Superior branch from Fort William to Superior Junction, Ontario. The jurisdiction of the heads of departments of the Canadian Government Railways at Moncton has been extended over these lines.

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CAPTAIN C. L. CONACHER (formerly Traffic Manager, Cambrian Railways), who has been serving as a railway transport officer on the staff of the War Office since October last, has now been transferred to the Administrative Staff of the Ministry of Munitions in London. He retains his military rank, and serves under Sir Percy Girouard, the Controller-General of the Department.

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CAPT. C. FRYATT, Chief Engineer E. Smith, and Chief Officer C. Stiff, of the Great Eastern Railway steamer *Brussels*, have been awarded gold watches by the Lords Commissioners of the Admiralty, in recognition of the skilful way in which their vessel was navigated when she evaded an enemy submarine on March 28th.

* * *

THE free buffet for soldiers at London Bridge station, London, Brighton and South Coast Railway, which was opened at Whitsuntide, has been greatly appreciated by the men, and in one week as many as 7,000 meals were served. Gifts of ham, potted meats, cakes, fruit, tea, coffee, and cigarettes are requested.

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THE Board of Trade have recently confirmed the undermentioned Order made by the Light Railway Commissioners: North Lindsey Light Railways (Amendment) Order, 1915, authorising the North Lindsey Light Railways Company to raise additional capital and extending the time for the exercise of the powers under the North Lindsey Light Railways Orders of 1906 and of 1913.

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MR. WILSON, who has been Superintendent for the Great Southern and Western Railway at Limerick, has been appointed Goods Superintendent at Kingsbridge. The position was rendered vacant by the retirement after long service of Mr. Charles E. Carroll.

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AT the Midland Grand Hotel, St. Pancras, on June 8th, 1915, Mr. G. J. Whitelaw, Chief Accountant, Great Western Railway, was the guest at a presentation dinner given by his late colleagues of the Accountants' Committee, upon his resignation from the Chairmanship and membership of that body.

THE platform ticket system was introduced experimentally at four departure platforms at Paddington on May 17th, and the results attained have been such as to justify consideration of its extension to the station as a whole. Birkenhead, Chester, Falmouth, Trowbridge and Westbury are also stations where the introduction of the arrangement is under consideration.

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ON this page is reproduced a photograph of a prominent member of the Railway Club (London) —Lieutenant Malcolm Stewart Blane, Cameron Highlanders. Born 22 years ago, he is of the family of the Blanes of Blanefield, of whom the present principal representative is Sir Charles Blane, Bart., R.N.

Lieutenant Blane is the son of Captain Gilbert Blane, J.P., late Scots Guards. Educated at Eton and Oxford, where in July, 1914, he graduated in engineering science, he has done much in support of the Scottish national movement

Photo] *Elliott & Fry.*

LIEUT. M. S. BLANE,
Cameron Highlanders.

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and to the furtherance of the Celtic renaissance. He has lately been engaged in writing a big work on Scottish Railway Engineering with the intention of publishing it at the conclusion of the present war. Mr. Blane served for three years as trooper in the Oxford University Cavalry Corps, and was gazetted to the 3rd Battalion Q.O. Cameron Highlanders in May, 1914, and is now serving in France under Lochiel in the 5th (Service) Battalion of that honourable regiment.

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For use at Agricultural Shows, etc., the Great Western Railway have introduced an enquiry kiosk. The structure is octagonal, with a verandah and rail around it, and covers a ground area of about 20 ft. square. Inside, maps of the Great Western system are displayed, and a uniformed attendant is always in evidence to distribute literature and answer enquiries. The structure was first used last year; it has since been considerably improved.

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Mr. J. Argyle, M.Inst.C.E., Northern Divisional district engineer, Midland Railway, having retired, the Northern Division has been divided. Mr. H. Powell Miles, who has held the position of Southern Divisional district engineer since November, 1909, has been appointed to be Divisional Engineer of a new Central Division, extending from Derby, Trent, Nottingham, and Lincoln to Masborough and Manchester, including branches. Mr. C. B. Trye, who has been assistant to Mr. J. L. Lowe, Assistant Engineer-in-Chief (Maintenance), has been appointed Divisional Engineer to a new Northern Division, which extends from Masborough to Carlisle and branches. Mr. F. J. Greasley, from the Chief Engineer's staff, becomes Divisional Engineer for the Southern Division.

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Additional tracks between Abergele and Llanddulas, on the North Wales main line, London and North Western Railway, have been brought into use, so that there are now four roads between these points. At intermediate stations the platforms are alongside the down and up slow lines, with the express lines between them. From the Abergele end of Llanddulas Viaduct to Colwyn Bay two lines only are available, but it is intended to complete the widening works between Llanddulas and Colwyn Bay. From Llanddulas to Chester, about 38 miles, there are now four tracks except for 4 miles between Flint and Connah's Quay.

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Although the London and North Western (London) Athletic Club could hardly carry out their usual annual sports, on account of the War, the Children's Day was duly held at Wembley on Saturday, June 5th. The prizes were handed to the successful competitors by Miss Grasemann, sister of Mr. Cecil F. Grasemann, Chairman of the Athletic Club.

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We regret to record the death in action of Second Lieut. Everard J. Druitt, 2nd Batt. Royal Berks. Regiment, the son of Colonel Druitt, of the Railway Department, Board of Trade. Lieut. Druitt, who was only 19 years of age, entered the service of the London and North Western Railway as a Probationer some 18 months ago and was engaged at Watford and Stanmore.

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The Caledonian Railway Company has forwarded to the Cumberland Infirmary at Carlisle a cheque for £250, in recognition of the skill and attention bestowed on the passengers injured in the Gretna disaster.

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Of 210 members of the Great Western Railway staff in the Motor Department at Slough, 67 have joined the Colours. This represents nearly 32 per cent. of the men attached to that depôt.

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One of the most attractive of the many agencies that are at work in Manchester for alleviating the lot of wounded soldiers in the hospitals is the *Daily Dispatch and Evening Chronicle* scheme for the collection of flowers. The scheme was inaugurated in order to ensure a regular supply of choice flowers for the numerous hospitals in Manchester and district, and the co-operation of the Railway Companies was

Photo] [*Daily Sketch.*

FLOWER RECEPTION STALL AT VICTORIA STATION, MANCHESTER, LANCASHIRE & YORKSHIRE RAILWAY.

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enlisted as so many business people live in the suburbs, or the resorts within an easy run of Manchester, where they pursue their hobby in horticulture. Arrangements were made with the Lancashire and Yorkshire Railway for the reception of the flowers as the passengers arrive by train each morning. There has been a ready and practical response to the appeal, and on the collecting days Victoria station, like the other stations in Manchester, has a stall specially erected to receive the flowers. Lady helpers are in attendance, and many are the fine bouquets which are presented to them by generous hearted travellers. A view of this stall is reproduced.

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THE French Government have contracted with Messrs. Kerr, Stuart & Co., Ltd., of Stoke-on-Trent, for the early delivery of 35 main line locomotives for service on the French railways.

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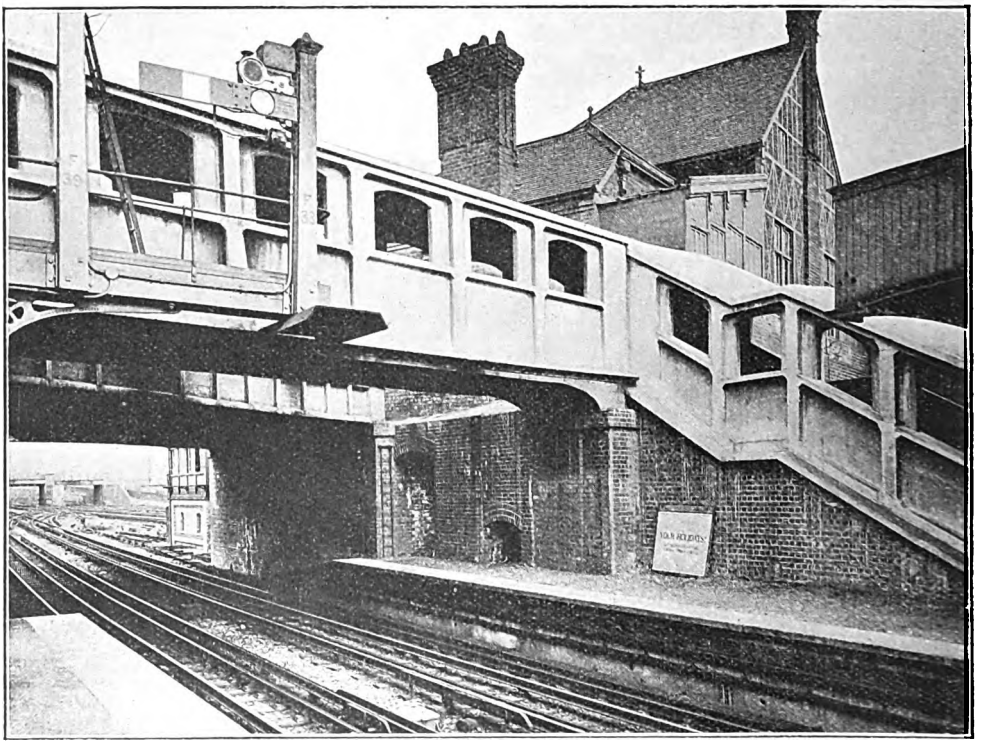
THREE new colour posters issued by the Great Eastern Railway may be commended. One is a bathing scene suggestive of the usual summer attractions at coast resorts, and will appeal to those who can, even under present circumstances, spend a vacation or a few days at one or other of the favourite resorts served by the Great Eastern Railway, while the other two show scenes depicting children in enjoyment of what the country has to offer at this period, with the injunction to "spend your holidays in East Anglia."

* * *

THE directors of the North Eastern Railway have appointed Mr. Henry Wight to be Chief Cashier of the company in place of the late Mr. J. H. G. Dickinson. Mr. Wight has been in the service of the company over 27 years, and for the last eight years has acted as chief clerk in the department to which he has now been appointed the head.

* * *

IN the main line booking hall at Liverpool Street station, Great Eastern Railway, a large frame has been fixed containing the names of 3,800 Great Eastern Railway men who have joined His Majesty's Forces. The position is a commanding one, and while the list of names is already a long one, space is available for additions as required.



FERRO-CONCRETE FOOTBRIDGE AND STAIRWAYS AT NEASDEN STATION (MAIN LINE SIDE), METROPOLITAN RAILWAY.

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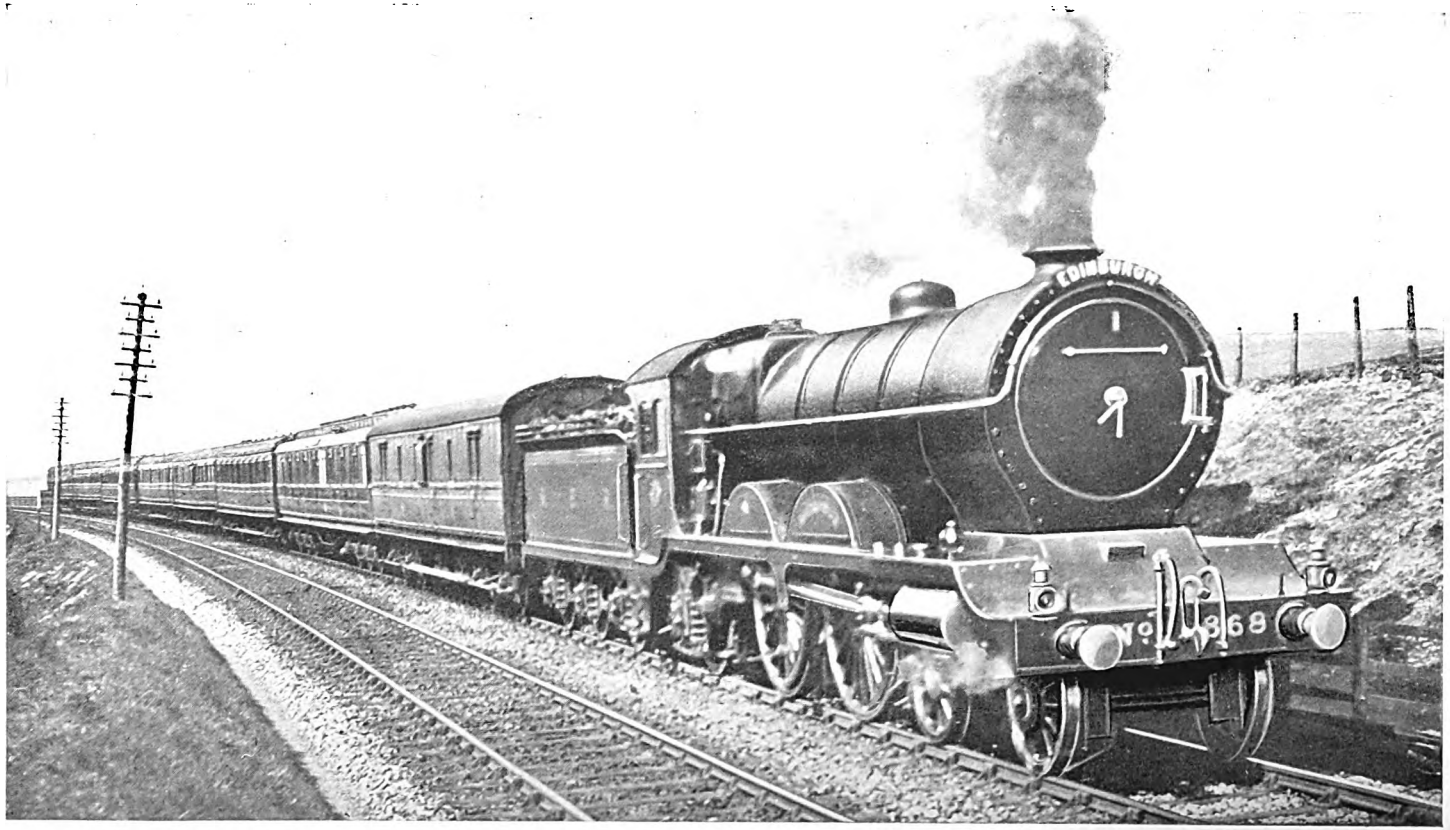

Photo] [*A. J. Cheyne.*

NORTH BRITISH RAILWAY.

10.20 a.m. Aberdeen-King's Cross Express near St. Fort.
Atlantic Locomotive, No. 868, "Aberdonian."

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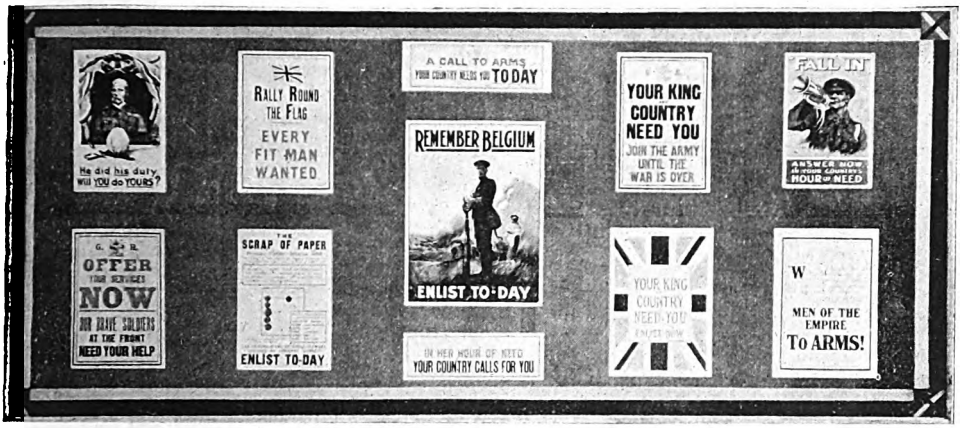

British Railway Officers in War Service [No. I.]

QUITE early in the war statistics showed that at least 77,000 railwaymen had joined His Majesty's Forces on sea and land. Since then there have been considerable increases, as steps have been taken, as by the introduction of female labour at stations and in offices, by combining representations of railways serving the same places, and otherwise rearranging business aspects of railway work to enable further men to be released, while the formation of railway sections of the Royal Engineers has added several thousands more. There is little doubt that the total is now well over 100,000, and while we have not complete data it will be interesting to compare the totals given in the current *Railway Year Book* with later figures. It must be remembered that by the beginning of 1915 most railways had already reached their then practicable limits, and railway servants were only allowed to enlist by special permission, as the staffs had been so seriously depleted that there were decided risks that the efficiency of the railways would suffer. Yet, as a result of further developments, we find very appreciable additions to the figures then given, as shown by the following comparison, which it must be noted applies only to railways concerning whom recent data is available. Later figures are given as for July, that being a reasonable compromise for the varying dates of compilation, while early figures are given as for February.

	Feb.	July.	+
Caledonian	2,000	2,500	500
Cambrian	137	203	66
Cheshire Lines Committee ..	500	600	100
Dublin and South Eastern ..	41	69	28
Great Eastern	3,600	4,600	1,000
Great Northern	2,650	4,300	1,650
Great Northern of Ireland ..	229	442	213
Great North of Scotland ..	232	274	44
Great Western	10,137	13,265	3,128
Highland	183	226	43
Lancashire and Yorkshire	4,189	5,926	1,737
London and North Western	12,177	15,859	3,682
London and South Western	2,424	2,953	429
Midland	9,000	10,200	1,200
Midland Great Western ..	98	150	52
North British	2,000	2,378	378
North Eastern	6,200	7,500	1,300
North Staffordshire.. ..	504	600	96
T.O.T. Combination ..	4,500	8,000	3,500

Thus, taking only 19 lines, some 19,000 additional men are now added to the fighting forces, and this is quite apart from what railwaymen are doing at home. Many chief officers are actively assisting in important war positions, while it is an open secret that nearly all the large railway workshops are doing a great deal of war work, making and equipping rail and road vehicles, including large numbers of road motor cars, lorries, wagons, etc.; gun carriages; stretchers; filters, and a hundred and one other things,

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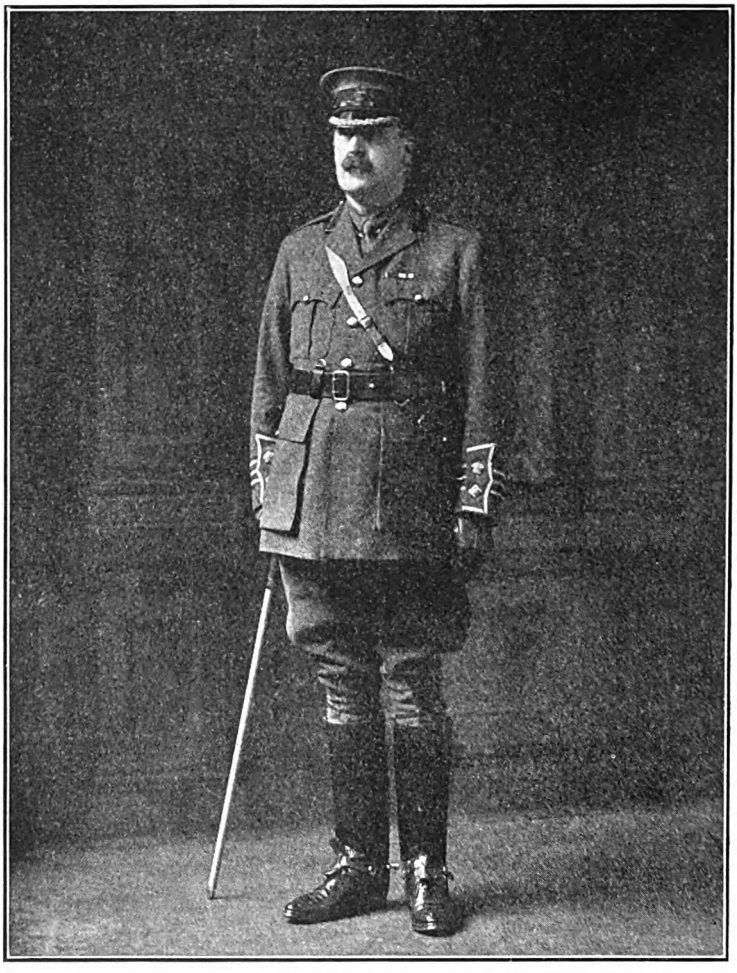
besides actual munitions, now a very important factor, as so much railway workshop machinery is suitable therefor and large numbers of really skilled workmen are necessarily to be found in all the great railway hives of industry.

But these aspects have already received attention in the RAILWAY MAGAZINE, and we are now concerned more particularly with the military services rendered by chief, departmental and other responsible officers of British railways with the actual fighting forces. In a sense all railwaymen are working in national service, and all chief officers might be included. Thus, we find that most of the general managers, besides a number of other railway chief officers, hold commissions in the Engineer and Railway Staff Corps. Sir William Forbes, General Manager, London, Brighton and South Coast Railway, is Lt.-Col. Commandant, while the 30 or so Lieutenant-Colonels and the 25 Majors necessarily include a large number of railway chief officers whose names are more or less household words in the railway world. These distinctions are, however, associated primarily with the conduct of our railways to meet war requirements, enabling the chief officers to administer the railways and at the same time giving



Photo] [*London Stereoscopic Co.*

COLONEL W. J. GALLOWAY.

Director, Great Eastern Railway.

Attached to the Headquarters Staff of the War Office.

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them suitable army rank. Most of the members of the Railway Executive Committee were already included in this force, and probably all now hold rank therein.

In regard to actual war service, British railways have a very fine record, and on this basis some particulars of chief and other responsible railway officers engaged with His Majesty's Forces on Land and Sea, or associated directly with munition and other war work at home, will be of value. It must be understood that no attempt is made at absolute completeness; to review all the appointments, even of commissioned officers only, would require much more space than is now available. In this article, however, are collected together many particulars pertinent to the subject, and of general personal interest; and the writer has to acknowledge the courteous co-operation of many railway officers, without whose assistance much of the information now included could not be presented.

First in respect of the railway appointments in connection with the formation of a Ministry of Munitions. Three well-known railway men were early selected by Mr. Lloyd George, Minister for Munitions, to assist him, these being Mr. E. C. Geddes, Deputy General Manager, North Eastern Railway, now Deputy Director General of Munitions Supply, Mr. Henry Fowler, Chief Mechanical Engineer, Midland Railway, and Major D. Bain, Carriage and Wagon Superintendent, Midland Railway.

Mr. Eric C. Geddes was originally intended for the Army, but after passing preliminary examinations, went to the United States, commencing railway service on the Baltimore and Ohio Railway. In 1895 he left America and went to India and became Manager of the Powayan Steam Tramway —2 ft. 6 in. light railway, about 40 miles long. In 1899 he was appointed Assistant Traffic Manager to the Rohilkund and Kumaon Railway system, and a year later Traffic Manager, which post he held until October, 1904, when he joined the North Eastern Railway as Claims Agent. In 1905 he was appointed Commercial Agent of the Company, and became Deputy Chief Goods Manager in 1906. Six months later he succeeded to the post of Chief Goods Manager, and in 1911 accepted the post of Deputy General Manager. Mr. Geddes is a Lieut.-Col. in the Engineer and Railway Staff Corps.

Mr. Henry Fowler received his technical training at Mason's Science College, now the University of Birmingham, and subsequently served an apprenticeship at the Horwich works of the Lancashire and Yorkshire Railway. He then became assistant to Mr. George Hughes, at that time chief of the testing department of that railway, and now its Chief Mechanical Engineer. He afterwards succeeded Mr. Hughes, both as chief of the testing department and as gas engineer to the Lancashire and Yorkshire Railway, leaving in 1900 to take up a similar position with the Midland Railway. Mr. Fowler was appointed Assistant Works Manager at Derby in 1905, and in May, 1907, was promoted to be Works Manager. He succeeded Mr. Deeley in his present position in 1909.

Major David Bain served his apprenticeship with Messrs. Neilson, Reid & Co., locomotive builders, Hyde Park Works, Glasgow. After passing through the various departments, he entered the drawing office, where he remained about four years. In 1883 he joined the North Eastern Railway as leading locomotive draughtsman at Gateshead. In 1887 he was appointed assistant to the late Mr. Elliott in the Carriage and Wagon Department, and succeeded him on his retirement in 1890, remaining in charge of the department until 1902, when he was appointed by the Midland Directors to his present position. Major Bain was an active Volunteer for many years, having served in the forces in various capacities with the Lanarkshire, Durham County, West Riding of Yorkshire, and Derbyshire Regiments, and retired in 1907 with the rank of major. He has a seat on the Territorial Force Association of the County of Derby, and has rendered good service in this military capacity since the outbreak of war.

The Ministry for Munitions is assisted by a number of Committees and a considerable number of our locomotive superintendents and chief mechanical engineers are included on these. There are also several other appointments, some of which may be briefly reviewed.

Captain E. O'Brien, R.E., Assistant Mechanical Engineer at Horwich, Lancashire and Yorkshire Railway, has been appointed as Mr. Henry Fowler's Assistant in the Ministry of Munitions; whilst Mr. Oliver Winder, who was at Horwich as Works Manager a few years ago, has been directed to take charge of the Yorkshire district

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Photo] [W. H. Winter.

MR. HENRY FOWLER.
Chief Mechanical Engineer, Midland Railway.
Attached to the Ministry of Munitions.

under the department. It is noteworthy that Messrs. Fowler, O'Brien, and Winder were all trained at Horwich when Mr. J. A. F. Aspinall was Chief Mechanical Engineer of the Lancashire and Yorkshire Railway.

Major R. L. Wedgwood, R.E., the Chief Goods Manager and Passenger Manager, North Eastern Railway, who was acting as D.A.D.R.T. (in the Transport Establishment) in France, has been recalled to join the Department.

Mr. Mervyn F. Ryan, who is now assisting the department, is Assistant Locomotive Engineer, London and South Western Railway. He entered the Midland Railway Locomotive Works as a pupil under the late Mr. S. W. Johnson. After completing this training he was engaged in the Testing Department of the General Electric Company at Schenectady, New York, and also in the Motive Power Department of the Pennsylvania Railroad Company, at Altoona, Pennsylvania. On returning to England he was employed as Inspector in charge of the Piecework and Premium office of the Midland Railway Locomotive Works; from this post he was promoted to Assistant to Works Manager. In 1911 Mr. Ryan became Locomotive and Carriage and Wagon Superintendent of the Somerset and Dorset Joint Line, until his appointment as Assistant Locomotive Engineer of the London and South Western Railway.

Captain C. L. Conacher (formerly Traffic Manager, Cambrian Railways), who has been serving as a railway transport officer on the staff of the War Office since October last, has been transferred to the Administrative Staff of the Ministry of Munitions in London, with the rank of Staff-Captain on the War Office Headquarters Staff.

Mr. Alfred Ingram, who was Carriage and Wagon Superintendent of the Metropolitan Railway during its electrical conversion, is assisting Mr. D. Bain. Mr. Ingram since leaving the Metropolitan Railway Company has been dealing with railway and rolling-stock matters at Westminster.

As a side issue may be mentioned the appointments of Sir Gilbert Claughton (Chairman, London and North Western Railway Company), Mr. Evelyn Cecil, M.P. (Director, London and South Western Railway), Mr. J. F. Mason, M.P. (Director, Great Western Railway), and Mr. J. H. Thomas, M.P. (Organising Secretary, National Union of Railwaymen), as members of a National Retrenchment Committee recently appointed.

Now as to the actual fighting forces, which include a large number of well-known railway officers, and not a few directors of railway companies. In regard to the latter the following gentlemen may be noted:

Mr. W. J. Galloway, so well known in connection with musical activities on the Great Eastern Railway, now holds a commission as Colonel, Royal Engineers, and is attached directly to the Headquarters Staff at the War Office. We are indebted to

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MAJOR J. H. SMEDDLE.
8th Durham Light Infantry (T.);
Locomotive Superintendent, Southern Division,
North Eastern Railway.

employés upwards of 100 commissions are held. The Locomotive Department includes the largest total, and the following may be noted: Mr. F. D. Earl, an assistant to the Works Manager at Crewe, 1st Lieut. Bucks Light Infantry; Mr. E. Price-Jones, also an assistant to the Works Manager at Crewe, Lieut. 1st Cheshire Royal Engineers; Mr. G. R. Jackson, assistant to the Road Motor Superintendent, Lieut. Army Service Corps (Motor); Mr. H. P. M. Beames, an assistant to the Chief Mechanical Engineer, Captain, Royal Engineers (Special Reserve); Mr. G. J. Louis, an assistant to the Running Superintendent, Lieut., Army Service Corps (Motor); Mr. E. G. Purser, also an assistant to the Running Superintendent, Lieut., East Lancashire Reserve Divisional Engineers; Mr. T. Lawrence, temporary assistant to the Running Superintendent, 2nd. Lieut., Mechanical Transport Section, Army Service Corps; Mr. A. G. Ivatt, Assistant Outdoor Department, 2nd Lieut., Army Service Corps.

From the Engineer's Department may be noted Mr. W. E. Thornhill, Divisional Engineer, Crewe District, who is Captain in the London and North Western section (118th Company) of the New Railway Troops, Royal Engineers. Other engineering appointments include Mr. A. R. Finlayson, Engineering Assistant, Coventry, 2nd Lieut., Royal Warwickshire Regt.; Mr. A. G. Smith, Steelwork Assistant, Euston, Lieut.-Commander, Royal Naval Volunteer Reserve; Mr. H. A. Hull, Resident Engineer, Coventry, Lieut.-Col. 6th (Reserve) North Staffs Regt.; Mr. C. E. Farrar, Engineering Assistant, Kilburn, 2nd Lieut., 73rd Mechanical Transport Co., Army Service Corps; Mr. H. E. Footner, Resident Engineer, Llandulas, Lieut., Royal Naval Volunteer Reserve; and Messrs. F. G. T. Adams, G. F. Trench, S. O. Cotton and W. H. Gyles, Lieutenants in the new railway troops. In the Rolling Stock Department may be noted Mr. M. W. Brown, Assistant Superintendent, Crewe, who is a 1st Lieut. graded as Staff Captain (for pay only), Royal Engineers (Railway Transport).

In the Carriage and Wagon Department at Wolverton, Mr. H. M. Williams (Assistant Superintendent, Outdoor) is Lieut.-Col., Oxford and Bucks Light Infantry, and Mr. C. L. Mason (Assistant Superintendent, Indoor) is a 2nd Lieut., Royal Engineers.

The Marine Superintendent at Holyhead, Commander G. E. Holland, C.I.E., D.S.O., is Lieut.-Col. Royal Engineers and Deputy-Director of Inland Water Transport.

The Electrical Department has supplied Mr. F. A. C. Leigh, Chief Electrical Engineer, who is Lieut.-Col., Western Signal Co., Royal Engineers; while Mr. P. D. Michod, Assistant, is Captain in the Special Reserve, Royal Engineers.

In the Goods Department may be noted, *inter alia*, Mr. C. Jones, Assistant District Traffic Superintendent, Bangor, who is Captain and Adjutant, North Wales Battalion, Royal Welsh Fusiliers; Mr. J. McLachlan, 2nd Outdoor Assistant, Dublin, who is Lieut., Royal Engineers (Railway Troops), and Mr. C. H. Tait, Outdoor

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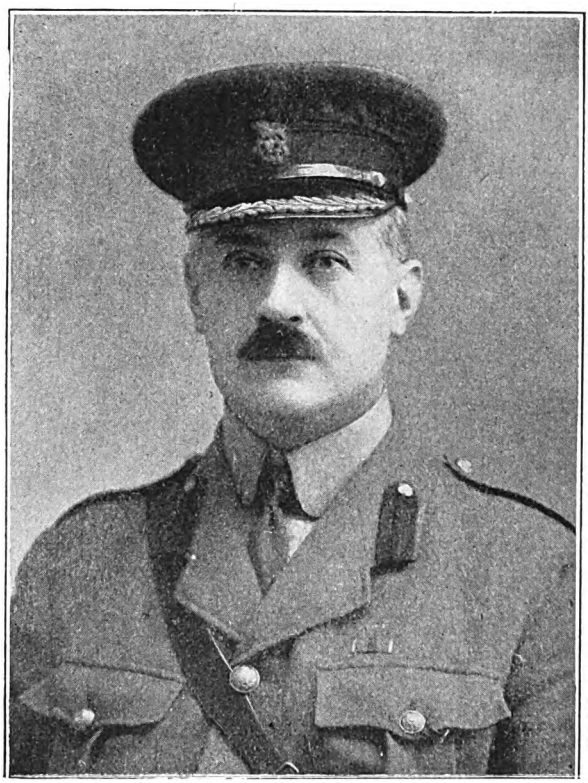

MAJOR W. T. F. HORWOOD.
Police Supt.: North Eastern Railway.
Major Horwood was called up from the Reserve of Officers on the 9th August, 1914, and was appointed a Deputy Assistant Adjutant and General at the War Office. In April this year he was transferred to the Provost Marshal's Staff with the British Expeditionary Force in France.

Goods Manager's Office, Derby; Capt. J. Kerr, Marine Dept., Heysham; 2nd Lieut. (Quartermaster) A. Herbert, Hotels Dept., Leeds; and 2nd Lieut. C. Arnold, Pupil-Fitter, Derby.

The North Eastern Railway has supplied about 80 commissioned officers. In regard to special appointments, reference has already been made to that of Mr. E. C. Geddes, Deputy General Manager, to the department of the Minister for Munitions, while Mr. H. A. Watson, General Superintendent, is a major in the Engineers and Railway Staff Corps. Mention has also been made of Mr. R. L. Wedgwood, Chief Goods Manager and Passenger Manager, who has been serving in the Railway Transport Establishment, but has since been recalled for service at home. In addition, Major T. F. Horwood, Chief of Police, is a Deputy-Provost-Marshal at the Headquarters in France, and Mr. J. H. Smeddle (Major, 8th Durham Light Infantry) is Locomotive Superintendent for the Southern Division. Major W. D. Rudgard (District Engineer, Bishop Auckland) is in command of the 2nd/1st Heavy Battery West Riding R.G.A. (Territorial), while Mr. B. Bland, Goods Department, Hull, who joined the 11th East Yorks Regiment and served as Sergeant Rifle Instructor, has been given a commission as Second Lieutenant in the Royal Lancasters.

From the South Eastern and Chatham Railway several interesting appointments have been made. Major H. C. T. Hildyard, the Managing Committee's Agent in Paris, is now a Deputy Assistant Director of Railway Transport, and has been mentioned in despatches; Captain F. Flood Page, R.E., Northern District Superintendent, is now in charge of the working of the docks at the Boulogne Base; Captain J. S. F. Higginson, District Engineer, is attached to the Kent Fortress, Royal Engineers; Major J. S. Wilson, R.E., an assistant in the Audit Accountant's Dept., is serving with the Railway Operating Corps (Headquarters Staff); Mr. A. L. Wilson, Assistant Veterinary Surgeon, is attached to the Army Veterinary Corps. The following assistants in the Superintendent's Department may be mentioned. Lieut. L. W. S. Grinling, Railway Transport Officer; Lieut. E. F. E. Livesey, Railway Transport Officer; Lieut. C. Grasemann, Railway Operating Corps; and Lieut R. M. T. Richards, Railway Operating Corps.

(*To be continued.*)

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Ambulance Trains for Service on the Continent.

TICKET OFFICE ERECTED FOR AMBULANCE TRAIN EXHIBITION AT EUSTON.

IN later issues of the RAILWAY MAGAZINE during 1914 particulars were given of the numerous "hospital" or "ambulance" trains placed in service on the home railways, in order to meet one of the special demands created by the European War in which we are concerned. In May, 1915, further ambulance trains were described, these being intended for service nearer to the immediate war area, and now we are able to deal with other trains for service on the Continent which have been and are being equipped at the works of several of the British railway companies.

Early in the war several ambulance trains were equipped for service on the French railways. Then came three trains supplied from this country, of which the cost of two was largely defrayed by the United Kingdom Flour Millers' Association. A fourth is known as the "Queen Mary" train, or as the "Lord Michelham" train, that nobleman having been largely associated therewith. There is also the Princess Christian Hospital Train, equipped in conjunction with the Red Cross Society, of which Her Royal Highness is President. These trains were described in the RAILWAY MAGAZINE for May, 1915. Four were built at railway companies' works here, largely utilising existing rolling stock suitable for adaptation; the Princess Christian train was specially built by the Birmingham Railway Carriage and Wagon Co., Ltd.

All these trains have rendered good service and are regularly in use; but with the growing demands of the war area additions are called for, and eight others, each consisting of 16 vehicles, are being supplied by various home railways. It is with these that we are now principally concerned, and the matter is of further interest in that some of them have been utilised for public exhibition, with a view to raising funds for the benefit of wounded soldiers, and especially the supply of comforts, etc., to those who have come from the railway service. A start was made by the Lancashire and Yorkshire Railway Company, their train being exhibited on July 9th at Exchange station, Liverpool, between the hours of 12 noon and 6 p.m. A charge of 1s. was made, the money collected being used for providing comforts for the soldiers and sailors at the auxiliary military hospitals in Liverpool. Nearly 5,000 people passed through the train during the hours noted, realising a sum of about £300.

The station platform was attractively decorated with bunting and flags, and there were in attendance thirty-two members of the Lancashire and Yorkshire Railway Centre of the St. John Ambulance Association in the Liverpool district, and a number were in the uniform of the St. John's Brigade. Several nurses also lent assistance in the pharmacy and staff cars. The Lady Mayoress (Mrs. J. E. Rayner), in the absence of the Lord Mayor, who was detained at an important meeting, opened the inspection. There were also present during the day: Sir George Armytage (Chairman of the Company) and Lady Armytage, Mr. Aspinall (General Manager) and Mrs. Aspinall, Sir George Pilkington (Director), Sir James and Lady

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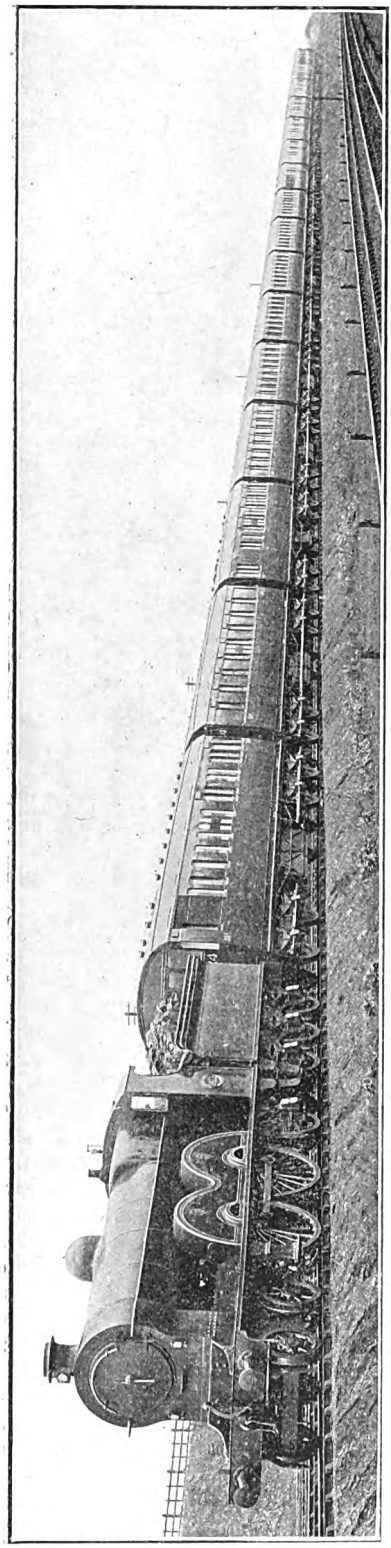
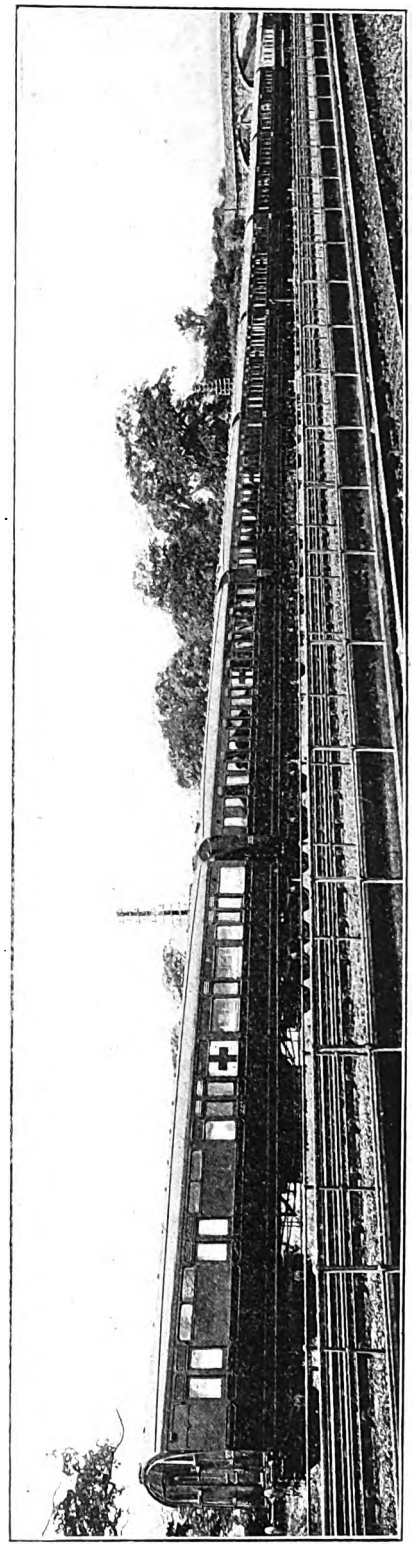


AMBULANCE TRAIN EQUIPPED BY THE LANCASHIRE AND YORKSHIRE RAILWAY FOR SERVICE ON THE CONTINENT.



VEHICLES INCLUDED IN AMBULANCE TRAIN EQUIPPED BY THE LONDON AND NORTH WESTERN RAILWAY FOR SERVICE ON THE CONTINENT.

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Barr, Col. Gemmell, Major Darwin, and many leading citizens of Liverpool. Mr. F. E. Gobey (Assistant Carriage and Wagon Superintendent, to Mr. G. Hughes, Chief Mechanical Engineer), under whose supervision the train has been constructed, and Mr. G. H. Nutter (Secretary of the Lancashire and Yorkshire Railway Ambulance Centre) were in attendance throughout the day and had charge of the arrangements.

We may here mention that ambulance men in the service of the Lancashire and Yorkshire Railway at the Liverpool station and depôts have attended all the ambulance trains arriving at Aintree since the commencement of the war, assisting in the transfer of 8,700 wounded soldiers to the hospitals, and the military authorities have on several occasions expressed their appreciation of the great service rendered by the railwaymen.

Partly in consequence of the conspicuous success realised by the exhibition in Liverpool, the London and North Western Railway arranged for the exhibition at Euston of the more interesting vehicles of one of the trains equipped at Wolverton Carriage Works, under the direction of Mr. H. D. Earl, Carriage and Wagon Superintendent. These were placed at No. 12 platform on Wednesday, July 21st, and open for inspection between 8.0 a.m. and 6.30 p.m. A charge of 1s. was made for each person inspecting the vehicles, the money collected being devoted to the fund for providing comforts for the Railway Troops (R.E.) serving with the Expeditionary Force.

A portion of No. 12 platform was partitioned off alongside the train and provided with an entrance gate and ticket office at one end, and an exit gate, where tickets were collected, at the further end. Several representatives of the Company were in attendance, going through the train with various parties. So great was the interest evinced that the exhibition was continued on the following day, with equally satisfactory results.

On Wednesday a party of high officers from the War Office attended at an early hour, and Mr. Guy Calthrop (General Manager), Mr. L. W. Horne (Superintendent of the Line), Mr. E. F. C. Trench (Chief Engineer), and, in fact, virtually all chief and many other officers of the London and North Western Railway went through the train during the morning. Numerous officials from other railways also came along, and there were many people of note, both in public and private life. Several parties of nurses from London hospitals were among the visitors, and on Thursday afternoon about 500 non-commissioned officers and men of the 2nd Division, London District, R.A.M.C. (T.) were given facilities for inspecting the train.

Ladies constituted a considerable proportion of the visitors, and a notable feature of the day's proceedings was the number of suburban residents who had plainly come to town for the purpose, or had combined a visit to Euston with other engagements. Besides the sums realised by the charge of 1s., collecting boxes were well supported, while the collecting dog "Brum" was not behindhand in soliciting contributions in his own way, his record being about £6 6s. (mainly in coppers) on the first day, while with another dog now in training a further sum of over £2 was added on the second day. Altogether, a sum of over £323 was realised by the exhibition, and about 6,000 people passed through the train.

The same train was then shown at Cannon Street station, South Eastern and Chatham Railway, on Tuesday, July 27th. A charge of 1s. was again made for each person inspecting the train, the money collected being given to the fund for providing comforts for the Railway Troops (R.E.) serving with the Expeditionary Force. The total number of persons who inspected the train was 3,968, and a sum of £212 8s. (£14 of which was collected by a dog) was realised. The Lord Mayor of London was amongst the visitors.

By the courtesy of officials of the Lancashire and Yorkshire and London and North Western Railways we are able to illustrate and describe these trains, which differ in several respects from ambulance trains previously dealt with in the RAILWAY MAGAZINE.

The Lancashire and Yorkshire Railway train constructed at the carriage works, Newton Heath, consists of 16 bogie carriages, with a total length of 939 ft. 7 in. over buffers, and weighing when loaded 492 tons. The vehicles were withdrawn from ordinary traffic, and are of the modern elliptical roof design now standard on the Lancashire and Yorkshire Railway, being equipped in accordance with arrangements made through the Ambulance Trains for the Continent Sub-Committee of the Railway Executive Committee. The formation and

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accommodation of the train are: 1 brake van with stores (with accommodation for train guard), 1 kitchen car (3 cooks), 4 ward cars with cots for 144 lying-down cases, 1 pharmacy car with pharmacy, treatment room, office, and stores, 1 staff car (for medical officers and nurses), 4 ward cars for sitting-up cases (256 patients), 1 ward car for sitting-up cases (infectious, 64 patients), 1 kitchen car (3 cooks), 1 *personnel* car (32 persons), 1 brake van with 2 infectious wards and cots for 18 infectious lying-down cases; total 16 cars, with accommodation for 530 persons.

Vestibuled throughout, the train is fitted with electric light and fans, some of the latter in each ward being of portable type to fix upon any cot for cases calling for special treatment. The ward cars are enamelled throughout in white; the cots are in three tiers, and can be placed against the sides when not in use. The middle berth can also be lowered to form a back for sitting-up cases when required. The kitchens are fitted with standard Army ranges, supplied by the London Warming and Ventilating Co., Ltd., coupled to a hot water installation, providing a constant supply of 50 gals. of hot water in each kitchen. The water supply on the train is a very important matter, and ample storage is carried on each car, the total for the whole train being about 2,000 gallons.

The staff car is provided with messroom for the medical officers and nurses, and berths arranged so that they are convertible for day or night use; this also applies to the *personnel* car, and both of these vehicles can either be heated by steam from a locomotive or independently from a stove and hot water system according to the circumstances. The exterior is painted khaki with a Red Cross in the centre of each vehicle. Westinghouse automatic air brakes of the standard pattern are fitted throughout, and all the coupling-up arrangements have been made suitable for connecting to Continental locomotives.

This ambulance train provides much greater accommodation than those in use in Great Britain—perhaps one of the chief features is that every advantage has been taken in utilising the space for the comfort of the sick and wounded under all their many varying conditions, and also for the convenience and requirements of the medical officers, nurses, and *personnel*.

In the case of the London and North Western trains, the vehicles on view at Euston and Cannon Street included four ward cars, each containing 36 cots for lying-down cases; one pharmacy car, containing all necessary accommodation for medical appliances, and also a treatment room equipped with operating table, etc.; one staff car, with accommodation for medical officers and nurses; one *personnel* car, to accommodate orderlies, day and night (to sleep 28); two kitchen cars, with suitable accommodation for cooks, accommodation for stores, special stores, mess room, etc.; and one brake van, with separate wards for infectious cases. These 10 vehicles belong to one of the two ambulance trains just finished at Wolverton, and consisting each of 16 coaches. The remaining vehicles are of more usual classes, hence their omission, seeing that the platform was fully occupied with the rolling stock included.

All cars used by the staff and *personnel* are fitted with a special self-heating equipment, so that they are independent of the engine as regards internal heating. Drinking water tanks are provided as required, with padlock control for filling and drawing off. Throughout the train special candle brackets are fitted, for use when electric light is not available from the dynamo-driven electric carriage lighting equipment, though there is a good battery reserve.

Lighting is on Stone's system, in view of its suitability for service on coaches working to no fixed timetable and subject to long periods of standing and slow running. To meet the exceptional requirements of the case, use has been made of special dynamos which are capable of generating current at a speed of but little more than 10 miles an hour. These machines are of the latest type, and fitted with ball bearings. The supply is at 24 volts. The whole of the apparatus is of British manufacture.

Double doors are provided to all lying-down patients' cars, so that stretcher cases can easily be dealt with, and there are numerous windows, so that plenty of fresh air can be obtained as desired. Internal walls of open coaches, corridors, cooking and store compartments, mess rooms, etc., are all painted with white enamel, and designed so that there are no corners where dust may accumulate. Bedsteads are of folding type attached to the walls, and equipped with mattresses, etc., as usual. They have been specially designed to meet the exceptional requirements.

One car had the beds prepared for use, another showed them without the complete

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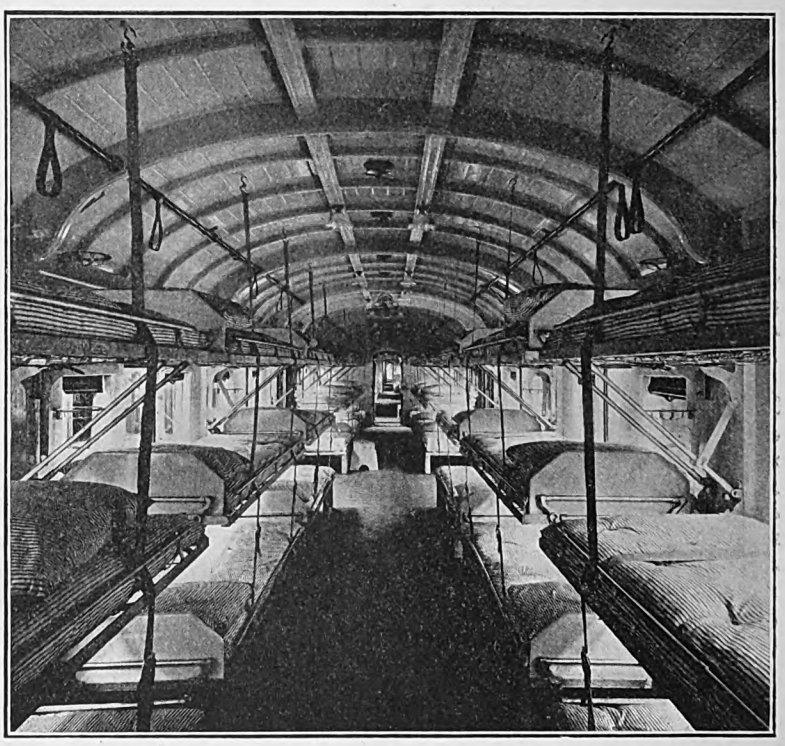
equipment, a third had the top tier folded up out of the way, while the lower ones were arranged to form comfortable couches for sitting-up cases. The fourth car had the bedsteads all folded up out of the way as for cleaning and washing out the cars. Heaters under each tier of cots are independently controllable, so that it is not necessary to heat the whole of a car to the same degree. Electric fans are provided in the cars, and a special feature is that besides fixed ventilating fans at each end and a punkah fan in the centre of each car, there are portable fans, supplied by flexible wall-plug connections, so that a draught can be caused to play upon the face of any patient who requires it.

One of the end car vehicles includes two wards, each complete in itself, for infectious cases, one for 12 patients and the other for six, thus enabling infectious cases of different kinds to be separated. The remainder of the car is divided off by an airtight partition, and accommodates the guard, who has a living compartment in addition to that used for train control. The *personnel* car is in compartments, each adapted for two berths on each side, the upper ones folding down to form backs to the lower ones for day use. Portable tables can be fitted as desired. In place of the usual racks, shelves are fitted near the roof.

The kitchen and mess room car includes accommodation for field officers' kits, longitudinally arranged mess room, cooks' room (with three beds), and a large kitchen fitted with Army Service range supplied by the London Warming & Ventilating Co., Ltd., refrigerator and crockery racks, etc. The stove is designed to ensure a supply of 50 gals. of hot water at all times, or large quantities of hot soup, etc. The staff car is reserved at one end for doctors and at the other for nurses. At the doctors' end the mess room has chairs on one side, and a seat on the other (this can be converted into a bed if desired), these facing a table for meals, while other compartments have a bed on one side and a seat on the other, arrangements being made so that tables can be erected as required. The nurses are similarly provided



INTERIOR OF WARD CAR: LONDON AND NORTH WESTERN RAILWAY TRAIN.

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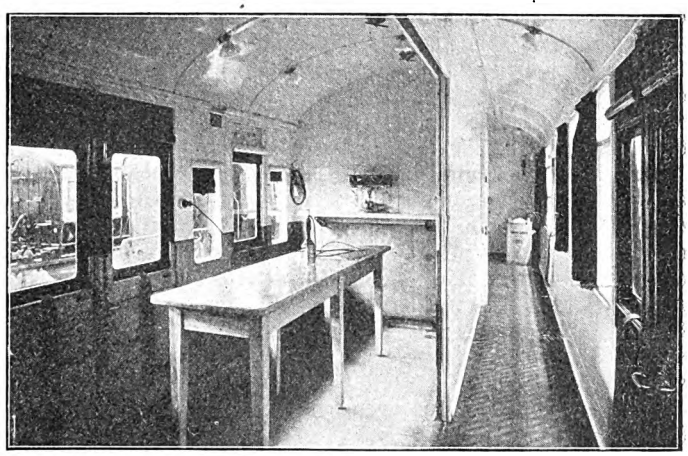
for, except that there are two beds in each compartment and their mess room is entirely enclosed.

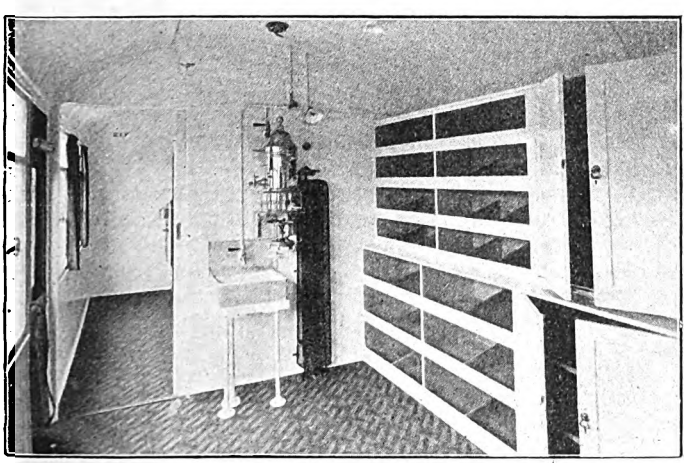
The pharmacy car includes "medical comforts store," office for officer commanding (with safe, writing desk, etc.), treatment room (zinc-lined, with full-width sliding door, operating table, sterilising appliances, etc.), dispensary (also fully equipped), and linen store. The second kitchen car includes cooks' compartment (three beds), stewards' store and pack store. The brake and stores car (not shown) has accommodation for the guard, with a living room adjacent, the remaining space being utilised for stores. All vehicles are painted khaki colour, with large red crosses on the sides of each.



TREATMENT ROOM: LONDON AND NORTH WESTERN RAILWAY TRAIN.

One of the ambulance trains recently constructed at the Great Eastern Railway's Stratford Works, for the use of the Army in France, was on view at Liverpool Street station, platform No. 1, from 7.30 a.m. to 4.15 p.m. on Thursday and Friday, August 5th and 6th. Tickets, at 6d. each, were sold at the west side suburban booking office. Afterwards it was on view at various stations on the Great Eastern system and no fewer than 50,354 people inspected it. The total receipts, including sums received from collecting-boxes, amounted to £1,311 0s. 7d. The total amount is to be given to the fund for providing comforts for the railway engineering section serving with the Army in France.

The vehicles on view were as follows: Four ward cars for lying-down cases, each containing thirty-six cots; one pharmacy car containing all necessary accommodation for medical appliances, and also treatment room equipped with operating table, etc.; one staff car, with accommodation for medical officers and nurses, for night and day; one *personnel* car to accommodate orderlies, containing sleeping accommodation for twenty-eight; two kitchen cars, with suitable accommodation for cooks, etc., messroom, accommodation for stores, etc.; and one brake van, with separate wards for infectious cases. The total train consists of sixteen vehicles, including, in addition to the above, five cars for sitting-up cases, and one brake van (with section for stores).



PHARMACY COMPARTMENT: LONDON AND NORTH WESTERN RAILWAY TRAIN.

By selecting No. 1 platform it became possible to include the complete train of sixteen coaches, though three or four were in the tunnel by which communication was once maintained with the Metropolitan Railway. Vehicles in the tunnel were, of course, illuminated. The selection of No. 1 platform was further convenient in that there are

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double staircases, and one could be used for admission and one for exit, a necessary separation in view of the continuous streams of visitors to be dealt with. People passed on to the platform by one staircase, and then had to walk the whole length alongside the train to the front end, entering it there and returning through the coaches to the extreme rear, whence they returned as far as the exit stairway. One of the windows of the west side booking office was devoted entirely to the issue of ambulance train tickets, and these were checked at the entrance to the platform and collected as visitors passed into the train.

The complete train of sixteen vehicles is 864 ft. in length, made up of 54-ft. cars, and weighs about 448 tons. There is accommodation for 162 lying-down cases and for 280 sitting-up patients. Water supply amounting to about 2,000 gals. is provided, nearly every car having a drinking water tank, the taps having, however, padlock control, as is found desirable where invalids under doctors' direction are concerned.

Seeing that it is made up from similar vehicles, this train includes many features corresponding to the train equipped at Stratford for the United Kingdom Flour Millers' Association described some time ago; but there are also a number of differences. Special sanitary arrangements are included; also a hot-water heating system, so as to be independent of the locomotive for steam heating as regards the staff and *personnel* cars. Other vehicles have Westinghouse steam heating equipment. The cots are also somewhat differently designed, and candle brackets are provided throughout the train so that complete dependence is not had upon the electric lighting equipment, though this, as is the case of other trains which have been described, has extra storage capacity. The system of electric lighting is Stone's, specially designed to suit the circumstances under which these trains will work. One of the five compartment patients' cars is intended for infectious sitting-up cases, in addition to the two ward compartments with cots for more serious cases in one of the end cars. As showing the complete "stores" equipment, the end stores car has a zinc-lined section with meat hooks for suspending meat supplies, in addition to racks and cupboards for other stores. In the staff and *personnel* cars the beds are provided in the form of upper and lower berths, adapted for conversion into seats, the upper berths forming backs for the lower ones when folded down. Similarly the cots in the ward cars can be converted into comfortable seats, the frames of the upper tiers being turned up out of the way. There are sixty-nine electric fans in the train, a few being portable. One of the staff lavatories is equipped with a shower bath.

As a result of the Ambulance Train exhibition at Liverpool Street, upwards of 14,000 people passed through the train on the two days; and so great was the interest taken that arrangements were made for its exhibition during the following week at various places on the Great Eastern Railway system. On Saturday, Aug. 7th, it was shown at Norwich; on the Sunday, at Yarmouth in the morning and at Lowestoft in the afternoon. The following day it was on view at Cambridge, on Tuesday, Aug. 10th at Ipswich, and on Wednesday at Southend. On Thursday it was shown at Witham (7.30 a.m. to 10.45 a.m.); Clacton-on-Sea (1.0 p.m. to 4.15 p.m.); and Colchester (5.45 p.m. to 9.0 p.m.). The next day it was at Bury St. Edmunds (8.45 a.m. to 10.15 a.m.), March (12.45 p.m. to 3.30 p.m.) and King's Lynn (5.0 p.m. to 8.0 p.m.). On Saturday, Aug. 14th it was on view at Hunstanton from 7.0 a.m. to 12 noon, and then came back to London, stopping at Bishop's Stortford from 4.15 p.m. to 8.0 p.m., ready for a further exhibition at Liverpool Street station, in response to numerous requests, on Sunday, Aug. 15th (8.0 a.m. to 8.0 p.m.) and Monday, Aug. 16th (7.30 a.m. to 4.15 p.m.). Most of the country exhibitions drew from 2,000 to 3,000 visitors per day, while the second exhibition in London realised further notable results. It is stated that while at Liverpool Street station the train was visited by 27,000 men, and as before remarked, the number of people throughout the Great Eastern Railway system who paid to inspect the train totalled no fewer than 50,354.

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Railways and Kindred Industries [No. I.].

NAPIER MOTORS.

By R. B. H.

NAPIER 3½ TON TRANSPORT VEHICLE.
Attached to Indian Army (Signals) in Flanders, with group of native signallers.
These lorries travel close behind the firing line and traverse the roughest trackless country.

WHEN railroad traction was first introduced into Great Britain, there were not wanting prophets who with confidence foretold the more or less speedy extinction of the horse and the relegation to the limbo of the past of all coaches and horse drawn road vehicles. The predictions of the abolition of equine-hauled rolling stock were, however, quickly falsified, for the railway companies were before very long among the largest horse-owners in the country.

With the advent of the road motor-car and its successful development came similar prophecies with regard to the railways themselves. Railways, said the quidnuncs, would soon be sold at scrap-iron prices and the transport of both goods and passengers would revert to those ancient highways commonly known as the turnpike roads.

New conditions, however, were not long in finding their level and although railway companies were at first somewhat chary of introducing motor road vehicles into their services the plunge was eventually made, and soon the prophets of railway decay were witnesses of the fact that the companies were ceasing to regard road motors so much as competitors as partners in serving the public.

Anyway, each year sees an increase in the number of railway-owned road motor vehicles in service on the roads of Great Britain, while further afield, in the oversea portions of the Empire, the road motor passenger car and road motor goods lorry are found performing admirable work in feeding the trunk railway lines with traffic.

It is not intended here to deal with the subject generally, but to restrict our

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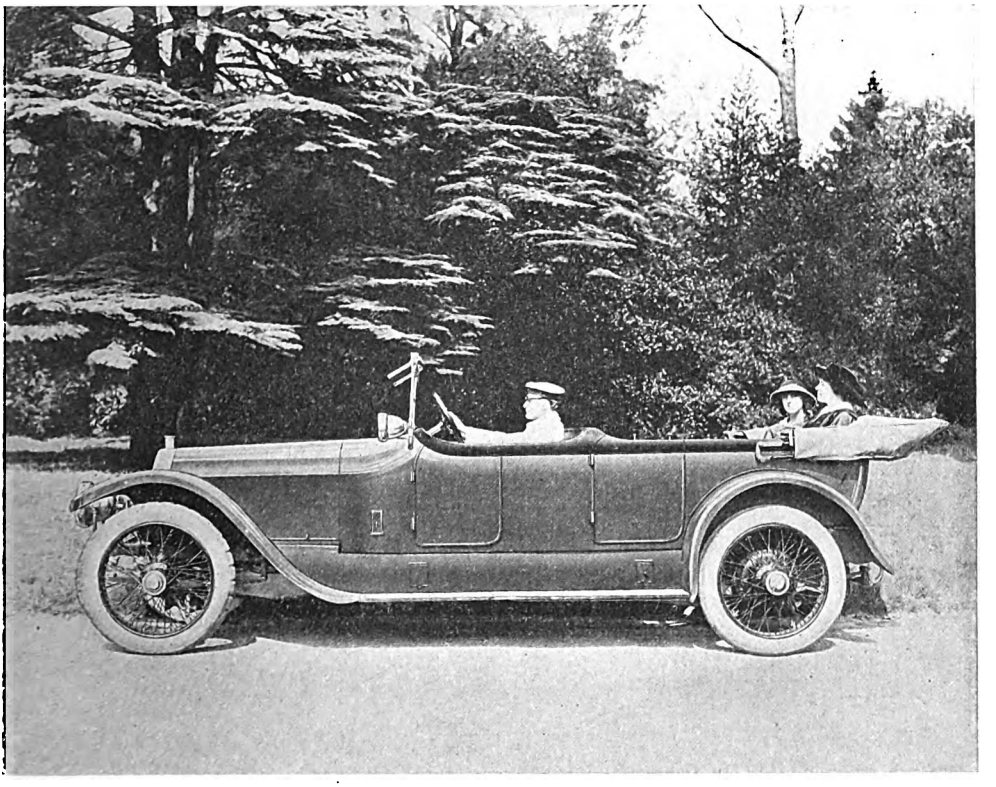
remarks to the operations of the famous firm of D. Napier and Son, Ltd., a corporation that has built up a world-wide business and occupies a foremost place in the motor-world.

On page 184 a view of the great Napier works at Acton, London, W., is reproduced. Here, for months past, thousands of the best type of skilled British mechanics have been strenuously engaged in the production of motor ambulances, military cars, lorries, transport wagons, and munitions of war for the British troops and their Allies at the front. It may be said without exaggeration, that no firm in the kingdom has shown more energy and enthusiasm in placing the whole of its resources—and they are huge—at the service of the country in the time of trial; and we are sure that this fact will not be overlooked by the many would-be buyers of Napiers who have been disappointed during the time when vital considerations of national safety have necessarily placed private requirements for the time being in the background.

It is impossible to over-estimate the value of the services rendered by the Mechanical Transport section of the Army Service Corps at the front, both in the rendering of prompt aid to the wounded and in the maintenance of an adequate supply of food, munitions, etc., at the firing line, and it is due to such firms as Napier that our own motor transport service is far and away the most efficient of any of the armies in the field.



FAMOUS ALPINE TESTED 30/35 6-CYLINDER NOISELESS NAPIER.
The first and only car to conquer the European Alps under the official observation of the Royal Automobile Club.

The exterior of the Napier Works, as shown in the illustration, conveys some idea of the importance of the firm and the extent of its operations, but in order to understand how the Napier has obtained and maintained its reputation as the leading car of the world, it is necessary to go through the various "shops," and see the car itself in course of construction. Permission to do this is readily accorded to anyone interested in motor matters on application to 14, New Burlington Street, London, W., and

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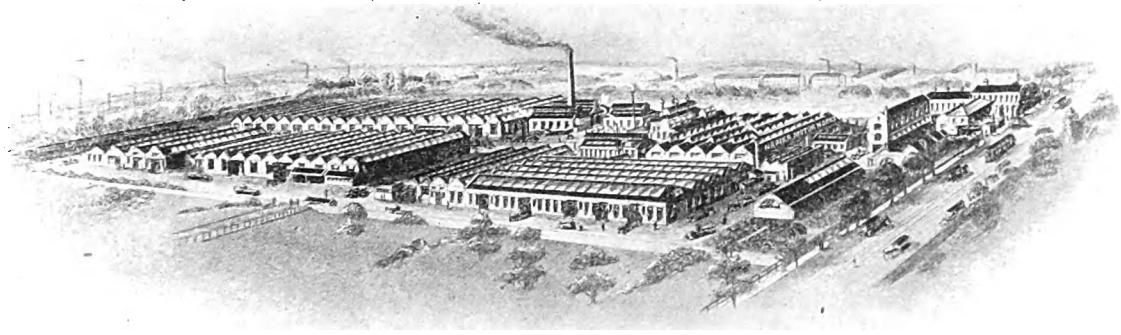

EXTERIOR VIEW OF THE GREAT NAPIER WORKS AT ACTON.

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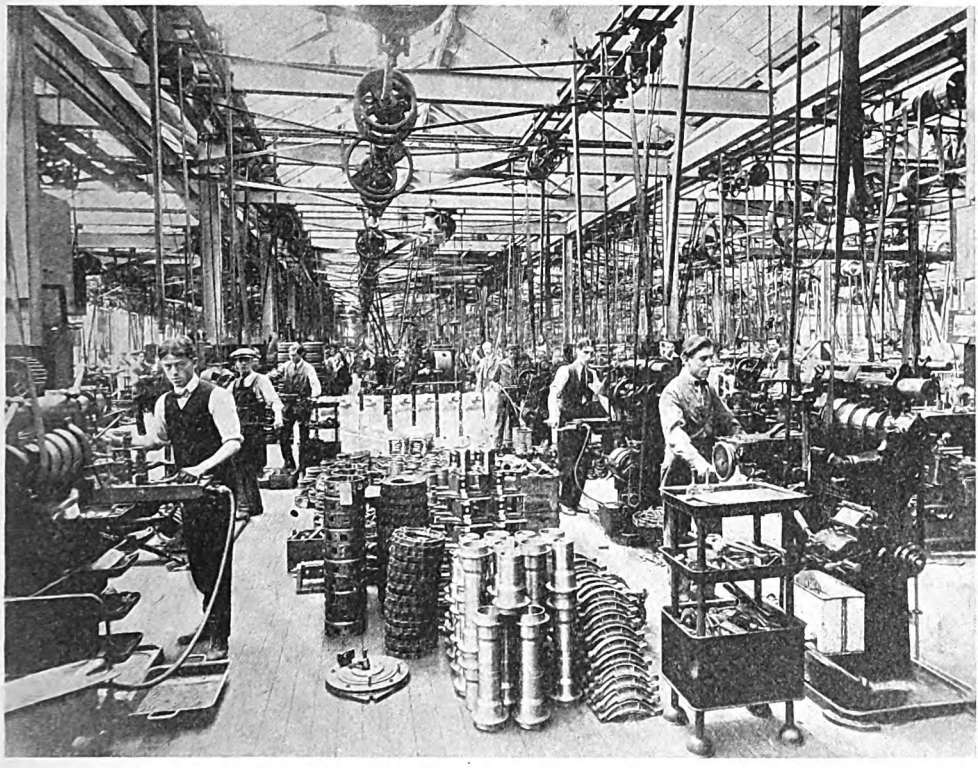
the present writer, who has made several visits of inspection, can promise that the tour will prove to be one of absorbing interest.

Apart from the numerous processes through which even the smallest "part" has to go before being finally passed to the assembling department, and the wonderful machinery—much of it exclusively Napier—used in the making of these parts, the visitor notes with admiration the perfect organisation which characterises the entire establishment. The work-rooms themselves are ideal in the matters of spaciousness and ventilation, and the hundreds of workmen in each of the rooms carry out the operations assigned to them without hurry or bustle, but with speed and efficiency. Such an organisation is not the product of a day, but the result of very many years of experience, and one is not surprised to learn that the history of the firm dates back a hundred years before the motor car was even thought of. But organisation in itself is not sufficient to explain the pre-eminence of the Napier among the world's automobiles.

The real explanation is to be found in the fact that for generations the Napier family has been entrusted with the manufacture of machinery for the Royal and other Mints, and right from the beginning of the motor industry in this country the firm has adopted in the manufacture of cars the same microscopic exactitude and fineness of correction as are essential in the making of minting and similar machinery of absolute precision. That is the reason the name of Napier is a synonym for mechanical perfection, and that is the reason one never hears of a Napier breakdown.



PORTION OF NO. 1 MACHINE SHOP (NAPIER WORKS, ACTON).

To give a list of even the principal events in which the Napier car has established its supremacy over all comers in international contests of every description would occupy much more space than is at our disposal, and at this stage in its career the recapitulation would be quite superfluous. But reference may be made to a few of the outstanding achievements associated with its

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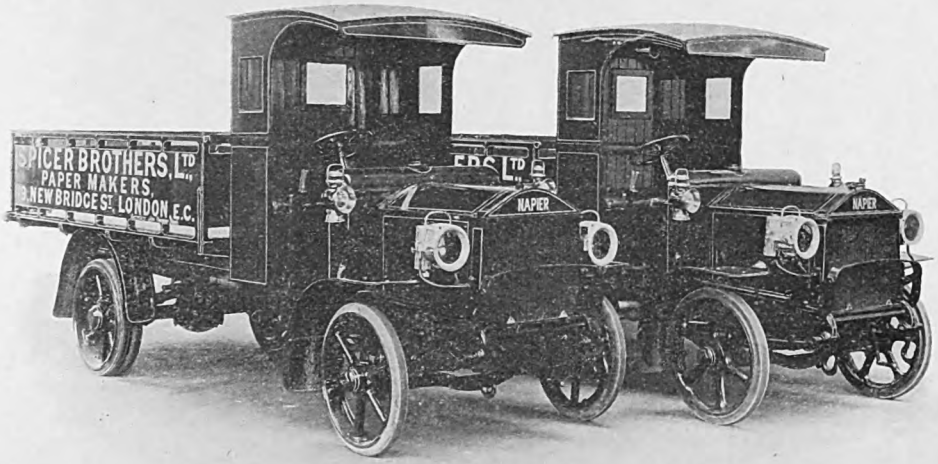

$3\frac{1}{2}$ TON NAPIER LORRIES.
Part of a fleet supplied to Messrs. Spicer Bros., Ltd., for railway delivery and collecting.

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name, and foremost amongst these is the great reliability trial under R.A.C. supervision, when three 60 h.p. standard six-cylinder Napiers ran consecutively—stopping only for tyres and petrol—for 24 hours, and each of them averaged well over 60 miles per hour throughout the entire run. Although this astonishing demonstration of efficiency and mechanical perfection was given as long ago as 1907, it still remains unbeaten, and is likely to remain so. The writer has always considered this to be the most remarkable performance in the annals of automobilism. Another noteworthy feature in connection with the Napier is that it was the first car to successfully introduce the six-cylinder principle, a principle which the leading makers all over the world have copied, or attempted to copy.

The Napier was the first and only British-built car to win the International Gordon-Bennett Trophy, and in so doing, showed the continental makers that the British car was no longer to be regarded as a negligible quantity in international competition. Innumerable other successes followed in contests of every description, until at length the recording of them in the Press became monotonous, and, having served their purpose, they were abandoned in favour of a series of exhaustive tests under R.A.C. supervision—tests of actual merit on the road in such matters as speed, reliability, smoothness of running, fuel economy, etc. This change of policy was a wise and timely one, as, after all, the user of a car wants serviceability on the road rather than speed on the track. The result is that the Napier at the present time holds three times as many R.A.C. certificates, for all types, as any other make of car.

NO. 3 MACHINE SHOP (NAPIER WORKS, ACTON).

Perhaps the most striking success of the Napier Company in recent years is the 20 h.p. extra strong Colonial model. When it became evident that there was a big future for cars in the Colonies, the Napier people realised at once that considerable modifications of the types suitable for this country

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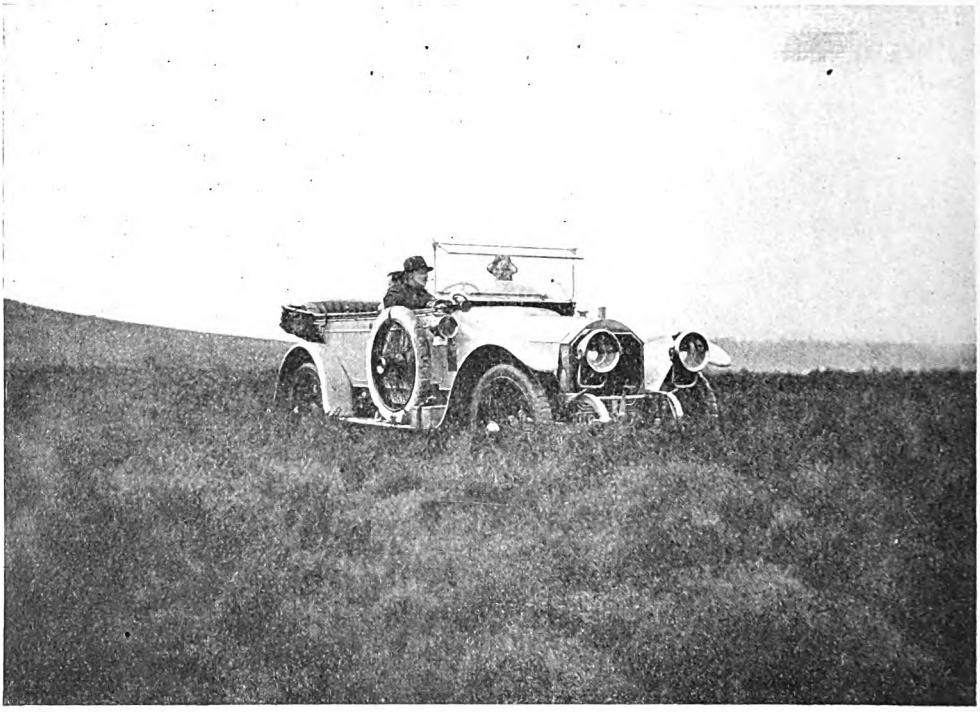
would be necessary, and sent experts to study on the spot the road and climatic conditions prevailing in South Africa, Australia, and our other oversea dominions. As a consequence, the Colonial Napier of to-day is admitted by general consent to be by far the best and most suitable motor vehicle for use in the Colonies—a popular verdict which was fully confirmed by expert opinion in July of last year, when for five consecutive days one of these models was subjected, under R.A.C. supervision, to such terrific treatment that one could only wonder there were any two parts of the car left together at the finish.

As a final word, it may be said that the present Napier *régime* is a very happy one. In Mr. H. T. Vane the company has an ideal general manager—genial, courteous, firm, and capable; and one, moreover, who has the faculty—by no means common with even the most capable managers—of selecting the right men for the right places under him, and of getting the best out of them.



FAR FROM THE RAILWAY TRACK!

A 20 h.p. extra strong Colonial Napier traversing virgin ground in New Zealand.

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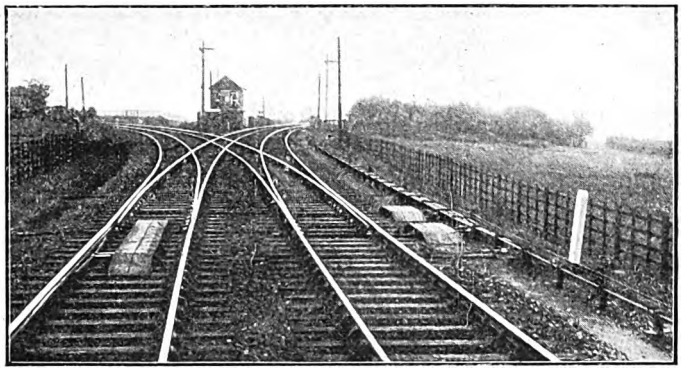
The Mansfield Railway.

By J. FRANCIS.



CLIPSTONE JUNCTION, WHERE CONNECTION IS MADE BY THE MANSFIELD RAILWAY (TO THE LEFT) WITH THE LANCASHIRE, DERBYSHIRE AND EAST COAST RAILWAY SECTION OF THE GREAT CENTRAL RAILWAY.

HAVING secured its Act in 1910, the work of constructing the Mansfield Railway was begun in the following year. Commencing at Kirkby by a junction with the Great Central Railway main line from London to Sheffield the Mansfield Railway passes through the town of Mansfield, and a few miles further on joins at Clipstone the Chesterfield and Lincoln section, originally part of the Lancashire, Derbyshire and East Coast Railway. In fact, in many respects the Mansfield Railway may be regarded as one which will materially affect the traffic arrangements of the Great Central Railway. It will be worked and maintained by the Great Central Company on a basis of 60 per cent. of the gross receipts. Incidentally it will shorten the distance between London and Grimsby by about 5 miles, and constitute an improved route for fish, goods, and other traffic between Grimsby and Lincoln, and Nottingham, Leicester and the South *viâ* the Great Central route. Leicester, Nottingham, and other towns will also obtain considerably improved routes to Mansfield and other centres.

At present the passenger by rail to Mansfield from the South goes through Nottingham by the Midland Company's route, 14 miles in length.

The new line will, therefore, provide a new direct route between Nottingham, and towns south thereof, and Mansfield. Indeed, it offers possibilities which entitle it to special consideration. It will give the Great Central Railway a new and shorter route between London and Lincoln and Grimsby, and placing Mansfield on what will be in effect, a new main route. It will likewise furnish an almost undeveloped part of the Nottinghamshire coalfield direct access to the splendid dock facilities now available at Immingham, to which it must prove a valuable feeder.

It is almost needless to say that coal has supplied the principal *raison d'être* for the construction of this line. The Mansfield Colliery of the Bolsover Colliery Co., Ltd., already has an output of approximately 1,200,000 tons per annum. Of this 500,000 tons per annum at least will go for shipment at Grimsby and Immingham. The Rufford Colliery also belongs to the Bolsover Colliery Company, and its output is estimated at about three-quarters of a million tons per annum. Some portion of this will go to the sea, and the Midland Railway takes some by means of a connection with the Newark line, but a considerable amount will no doubt pass over the Mansfield Railway. A further pit is now being sunk by the Bolsover Colliery Company at Clipstone. This colliery will be solely served by the Mansfield Railway, and it is estimated that there will be an output of approximately 1,000,000 tons per annum, and it will be equipped with a plant capable of raising that quantity.

The district is already well supplied with railways; in fact, there is quite a network and in its short length of 11 miles the Mansfield Railway crosses, or is crossed by, no fewer than six lines of railway, two Great Northern—including one not in use but crossed by a standard bridge allowing its utilisation at any time—and the other four Midland, while for most of its length it is in sight of, or only a few miles removed from, other lines, principally Midland. At the same time this busy part of Nottinghamshire offers scope for even greater traffic development, and in this respect the Mansfield Railway would justify itself, even without reference to the fact that it has been built primarily to assist the output of the Bolsover Colliery Company's "Crown

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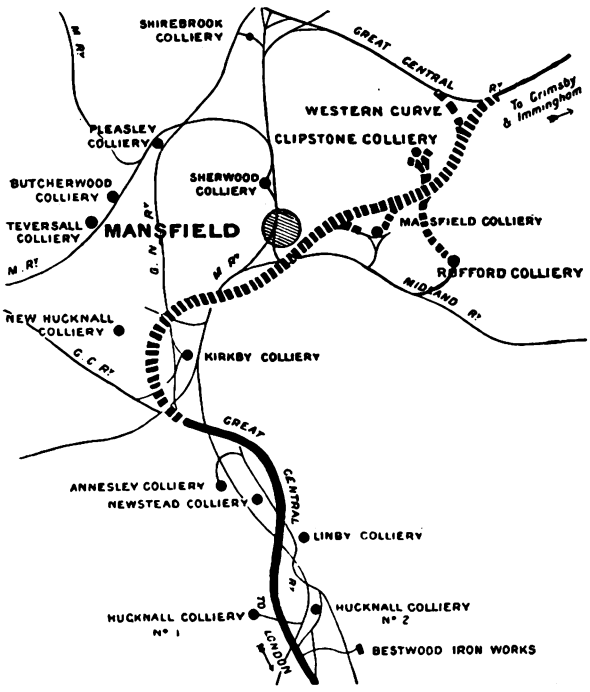

GENERAL MAP OF THE MANSFIELD RAILWAY AND ITS CONNECTIONS.

Farm" Colliery, near Mansfield (generally referred to as the Mansfield Colliery), as also of the same Company's Rufford Colliery, for the construction of a branch line to which work has just been commenced.

A portion of the line was brought into use in June, 1913, between the Mansfield Colliery and Clipstone Junction. Construction of the remainder of the line is well advanced, and a considerable mineral traffic is being conveyed over the section already in use. Between Mansfield and Clipstone Junction there are no intermediate stations; but on the southern section stations are in course of erection at Kirkby-in-Ashfield and Sutton-in-Ashfield, while Mansfield itself will have a station serving the side of the town which is now being principally developed, and which will be of a type and equipment suitable to its coming importance.

Mr. R. Elliott-Cooper, the well-known railway consulting engineer, is chief engineer on behalf of the Mansfield Railway Company; and the contractors for the whole of the construction, including the new branches to the Rufford and Clipstone Collieries which are now being taken in hand, are Messrs. Baldry, Yerburgh & Hutchinson, Ltd., of Westminster. Mr. C. B. Swan is in charge as resident engineer on behalf of Mr. Elliott-Cooper and the Railway Company.

Leaving the Great Central main line a short distance beyond Kirkby South Junction, where the Great Northern Company's Leen Valley line diverges, and under the control of the same signal cabin, the Mansfield Railway leaves on the up side, and rises on a grade of 1 in 126 alongside, to cross first the Pye Bridge and Pinxton section of the Midland Railway, and then the at present derelict Great Northern curve from the Leen Valley line to the Great Central Railway in the northward direction. Heavy rock excavation is here involved, and the work has been complicated by colliery workings in this district, and also by other special considerations.

The station at Kirkby-in-Ashfield will be a simple two-platformed structure, with neat station buildings on one side and usual accommodation at roadside stations on the other. At the western end of the station the railway passes under a main thoroughfare known as "The Hill." Immediately beyond the station are concentrated the principal difficulties of the line. The strata of the cutting is marl, bedded on a strata of sand of an average height of 6 ft. above formation level. From all the indications of the neighbourhood rock was expected at this point, and although preliminary borings suggested good hard rock throughout it was found in practice that it was of an extremely treacherous and varied character. Immediately beyond the station a brick retaining wall was anticipated, but even this had to be extended. On the other side it has been necessary to erect massive masonry retaining walls ranging from 6 ft. 6 in. to 9 ft. in thickness, and during the construction of the walls heavy timbers have had to be erected across the cutting. From about 74 chains to 1 mile 8 chains, at a depth of about 12 ft., from formation level, blue bind was encountered, and as this material is friable when exposed to weather, it has become necessary to face this length of the cutting with masonry walls about 2 ft. thick of an average height of 12 ft. from the foundation level. The rock cutting is continuous from Kirkby to the station at Sutton-in-Ashfield, and is spanned by

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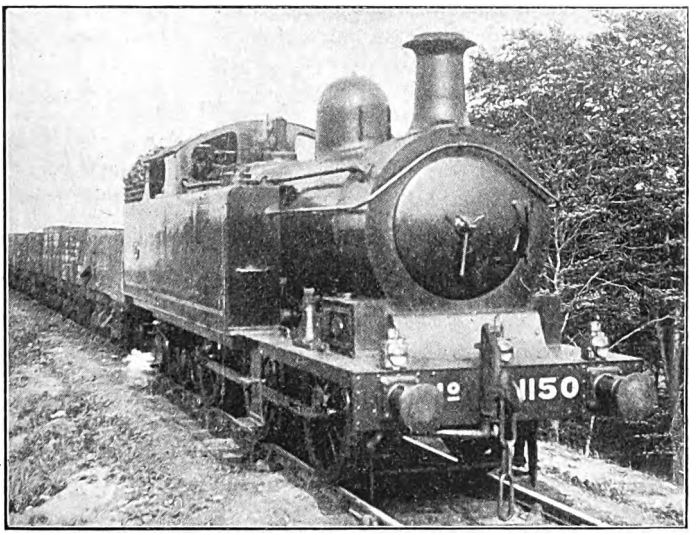
several substantial bridges, notwithstanding that some of them rank only as occupation bridges. Adjacent to Sutton-in-Ashfield station is a somewhat complicated section including two railway and one road bridge over the Mansfield Railway. The first of these is the Sutton crossing of the Leen Valley line, involving the erection for the Great Northern Company over the line of a skew bridge. A short distance further on the Sutton-in-Ashfield section of the Midland Railway is carried over the Mansfield Railway by a brick arch in the form of a short tunnel about 138 ft. long. Eight chains beyond, Forest Lane is carried over the railway.

Sutton-in-Ashfield station is generally similar to Kirkby-in-Ashfield, with neat platform buildings suited to the scope of anticipated traffic. The goods yard beyond, like that at Kirkby, will have three sidings, and one serving a coal yard, with a loading bank. The following section is on embankment, and this extends for a considerable distance. There are several under and over bridges between Sutton and Mansfield, some for "occupation" traffic only, but usually of a substantial character, and at 3 miles 35·8 chains, another railway crossing is involved, to carry the Midland, Nottingham and Mansfield line over the Mansfield Railway. By this time rock cutting has again been entered. There are only two lines of rail over, but the bridge had to be constructed with a view to widening to four lines of rail, so that the width between parapets is 58 ft.

Adjacent to Sheepbridge Lane bridge, not far from Mansfield, the line is carried on embankment, and crosses a corner of Bleak Hill Dam, a reservoir for an adjoining mill. As this sheet of water is very exposed, the effect of waves had to be taken into account, and, therefore, the foot of the slope on one side is faced with stone for about 2 ft., while piles were driven to carry two-plank protective sheeting. As the embankment is on a slight curve, in conjunction with the sheet of water and the picturesque surroundings, the view here is a decidedly pretty one. The embankment is about 12 ft. above water level.

On the outskirts of Mansfield is another Midland bridge over the line, carrying the Mansfield and Southwell branch. A short distance further on is the largest public road bridge on the line, over the main Nottingham road. In making this the roadway had to be lowered a little to obtain a headway of 17 ft. to allow of electric tramway services along this important thoroughfare. It is at an angle of 51 deg., of 48 ft. square span, 61 ft. 1½ in. skew span, and with 68 ft. face and centre girders.

Fronting Nottingham road, between the Mansfield Railway and the Midland Newark line (here at a higher level), are the entrance gates for the goods depôt. This rises on a grade of 1 in 200 from the buffer stops, to the level of the main line. Seven lines of rail have been laid, one passing into the large warehouse, 179 ft. long and 43 ft. wide inside. This is equipped with two whip cranes on the platform, and four bays for loading road vans. Goods offices are provided adjacent, and in the yard is a 10-ton crane serving two roads, while a 30-ton weighbridge serves the warehouse road, also cart weighbridge at entrance to yard. Each of the sidings will take 40 to 45 wagons. The whole of the yard is equipped with a comprehensive gas-lighting system. Beyond the weighbridge is a siding intended to be utilised for stabling one or more sets of empty passenger coaches,



GREAT CENTRAL RAILWAY 0-6-4 TANK ENGINE NO. 1150 (ORIGINALLY LANCASHIRE, DERBYSHIRE AND EAST COAST RAILWAY), BACKING WAGONS UP THE GRADE TO THE MANSFIELD COLLIERY "EMPTY" SIDINGS.

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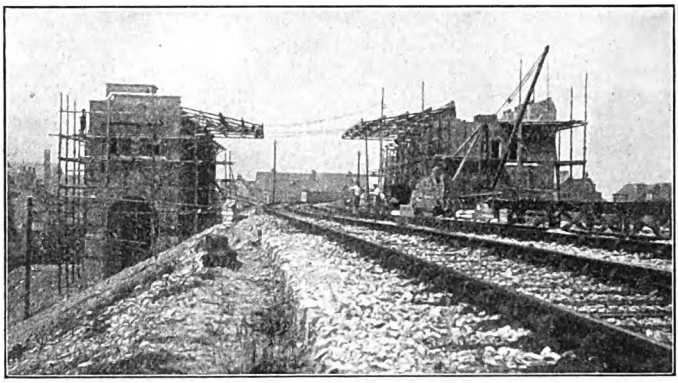

MANSFIELD PASSENGER STATION NEARING COMPLETION.

and beyond this again is space for an outside siding to serve proposed timber merchants' sites. Except for the last-mentioned the work here is virtually finished, and traffic is already being dealt with.

A few yards further on are three cattle pens and a loading bank. The former are equipped with complete provision for washing out, and the track serving them is designed to allow of cleaning the cattle trucks in compliance with the regulations of the Board of Agriculture. The pens are removable, so that in the event of extreme pressure on the loading bank they can be quickly dismantled, and the pen road utilised to amplify the loading bank capacity. On this side of the yard a thoroughfare known as Baums' Lane is being improved, and there will be access therefrom to the proposed timber merchants' siding and the cattle pens and unloading bank. On the other side of the line the railway is on embankment, maximum height 35 ft., overlooking the Mansfield Recreation Ground, with a public footway from Nottingham Road to Littleworth Road, and the River Maun between. There is also a down siding on the same grade as the yard on the other side of the main lines. At the foot of the embankment is a rather expensive retaining wall alongside the public footway above-mentioned.

At the end of the goods yard all tracks converge on to a three-line bridge over Littleworth Road. This is of rather interesting design, of 36 ft. square span, and a skew span ranging from 36 ft. 8 in. to 39 ft. 10 in., the main girders being 44 ft. long, and there is also a side arch span of 30 ft., formed with relieving openings. Of the three lines concerned, two are the main lines, and the third a running siding connecting the passenger and goods stations. On the other side of Littleworth Road is the Mansfield passenger station yard. On the down side of the high embankment a spur road is contemplated to form a high level access to the yards of the Mansfield Gas and Electricity Works adjacent, the height of the railway rendering this convenient for the installation of a coal-tipping and ash-handling plant. On the down side the siding mentioned will serve a carriage loading bank, and will then run into a bay platform for local and terminating trains. The up platform will be considerably longer than the down platform, as it has to serve also the terminal bay referred to.

The platform buildings are carried by piers on the down side; those on the up side being erected from ground level, with subway between the platforms. On the down side there will be the usual station offices; but on the up side the buildings are more elaborate. To give access, a new thoroughfare, to be known as Great Central Road, is being made, with a wide station approach. This will constitute a continuation of the new Baums' Lane, and will provide station access from Nottingham Road, Littleworth Road and Ratcliffe Gate. The station buildings will include refreshment rooms, etc., with the kitchen and staff accommodation on the top storey.

At the other end of the station the railway is carried in three arches in two spans over Ratcliffe Gate at a height of 25 ft. There are several other bridges before the town of Mansfield is left. As the sidings serving the Mansfield Colliery are approached a branch is put off on the up side towards the "empty" sidings of the colliery. There is also along this section a main relief line on the up side for mineral trains, continued at both ends as a siding, with a loop for part of its length. For a part of the distance there is also a siding on the down side.

Connection with the Mansfield Colliery empty, full and screen sidings is made in both directions. On the empty side, facing towards Mansfield station, the grade of the branch is at 1 in 75 with a down grade beyond the hump at 1 in 85. On the full side the spur descends at 1 in 90 and 1 in 70 to the main line, access being controlled by the Mansfield Colliery cabin. On the up side there is a long siding, and this is

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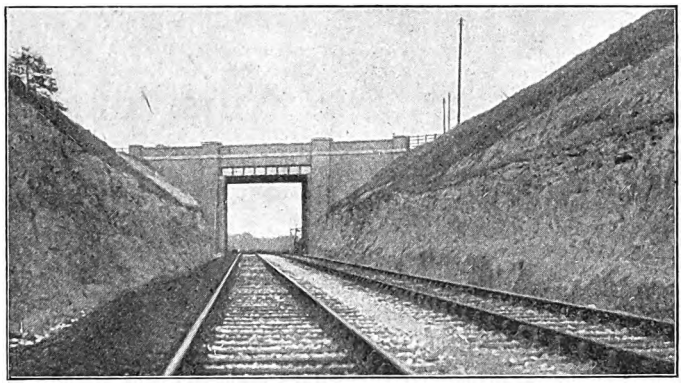
temporarily continued across the fields to give access to the works on the new Rufford branch. Behind the colliery the main line descends at 1 in 130 and 120 virtually all the way to Clipstone Junction, the grade, therefore, being in favour of the load. Near the colliery a big area has been excavated for use in making embankments, and this will be available for extending the siding accommodation when necessary.



PRIVATE ROAD BRIDGE AND NO. 7 CUTTING.

At present preliminary steps only have been taken for the construction of the Rufford and Clipstone Colliery branches, as also for the concentration sidings to be provided adjacent. At first the latter will each consist of five roads, on one side for empty wagons and on the other for full wagons, each road taking eighty trucks; but the complete scheme is for fifteen full-capacity lines in each group, giving space for 1,200 wagons on each side. The magnitude of this accommodation is sufficient indication of the traffic anticipated when the new pits are in full operation.

The junction at Clipstone is towards Lincoln and Grimsby only; but a new western curve is now being taken in hand and will give equal access towards Chesterfield and Sheffield. From the Rufford and Clipstone Colliery junctions there will be a relief down road or running siding through the down concentration yard right to the junction with the Chesterfield–Lincoln line. To-day there are only the two main lines.

It is hoped that the remainder of the line will be completed and brought into use before the end of the year. Meanwhile the foregoing particulars will indicate the importance and possibilities offered by this short but important addition to the railway mileage of the United Kingdom, and particularly in association with the Great Central Railway. We are indebted to Mr. Elliott-Cooper and to his resident engineer, Mr. C. R. Swan, for facilities for inspecting the line, and in conclusion may refer briefly to the gentlemen more directly associated with the constitution of the Mansfield Railway Company and the construction of its lines.

Mr. J. Plowright Houfton, J.P., Managing Director of the Bolsover Colliery, is Chairman, the other Directors being Mr. R. M. Knowles, Chairman of the Bolsover Company; Mr. W. J. Chadburn, of Mansfield; Mr. T. Craven, a Director of the Cambrian Railway; and Mr. S. W. Pilling, a Director of the Wrexham and Ellesmere Railway. The Secretary is Mr. H. A. Sanders, of Messrs. Davies, Sanders and Swanwick, solicitors, of Chesterfield. His firm promoted and carried through the Lancashire, Derbyshire and East Coast Railway Act of 1892, and the Sheffield District Railway Act, 1896. They have also been associated with the promotion of many other important Parliamentary undertakings.

Mr. R. Elliott-Cooper, a Past-President of the Institution of Civil Engineers, has been engaged for the last twenty years in the construction of railways in connection with the development of large portions of the Derbyshire, Nottinghamshire and Yorkshire coalfields. This development was initiated by the authorisation by Parliament of the Lancashire, Derbyshire and East Coast Railway in 1892, for which he was engineer. This was followed by the Sheffield District Railway, which gave access to Sheffield. He was also engineer for the construction of the Great Central and Midland Railway (Shireoaks to Laughton) and the Dinnington Colliery branch, which were promoted by the joint companies for the development of the South Yorkshire coalfield.

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100-Mile Runs during 1915.

BY reason of the War conditions are so exceptional that there would be no justification for including our annual tables of non-stop runs exceeding 100 miles in length were it not for the fact that the abnormal situation has created train working of special note, and after careful consideration it is thought that a record of those lengthy non-stop runs which were operated during this exceptional and eventful year will, in the future, be of historic importance, and on this basis it is presented as usual.

Of the nine railways which have figured in these tables in past years, only one, the Great Eastern, disappears entirely, for the reason that all the 100-mile runs usually recorded apply only to special summer traffic. The London and South Western Railway has only one of the special runs remaining, and all other lines include appreciable reductions. On the Great Central and Midland Railways several important trains have had additional stops added, while the latter and the Caledonian have so many conditional arrangements that several runs which might otherwise be included are omitted. The London and North Western, and Great Northern and North Eastern Railways retain many important runs mainly on the basis of the Scottish and business traffic, the Great Western being the only one which still records a large proportion of the express trains which possess special tourist and holiday value, and this notwithstanding the withdrawal of all except ordinary and tourist tickets. In the case of the Great Western Railway start-to-stop and slip journeys are noted separately thus: 4 + 1 = four start-to-stop journeys and one slip journey. On this occasion runs are noted on the basis of the ordinary public time tables, without any attempt to take into account working times, a matter of special complication on certain lines.

Great Western Railway (Thirty-Seven Runs and Five Slip Journeys).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
Paddington and Plymouth North Road *viâ* Westbury	225¾	1	4 7	54·8	10.30 a.m. D.
Paddington and Exeter *viâ* Westbury ..	173⅝	6+1	3 0	57·8	*10.30 a.m., 12 noon, 3.30 p.m. D., 1.45 p.m. U., †10.30 a.m. D.
Paddington and Taunton *viâ* Westbury	142⅞	4+3§	2 30	57·1	§10.30, *12 noon, *3.30 p.m. D., 11.0 a.m. U., 6.10 p.m. U., †2.45 p.m. D.
Paddington and Newport *viâ* Badminton	133⅜	*a*5	2 30	53·35	11.30 a.m. D.
Paddington and Worcester	120½	3	2 9	55·7	4.45 p.m. D.
Paddington and Bristol *viâ* Bath ..	118¼	1	2 0	59·1	11. a.m. D.
Paddington and Bristol *viâ* Badminton	117⅝	5	2 0	58·8	1.5 p.m. D., 12.0 noon and 5.5 p.m. U., †4.30 p.m. D.
Paddington and Birmingham	110½	4	2 0	55·25	11.5 a.m. and 2.35, 4.0 and 6.5 p.m. D.
Paddington and Bath	**106⅞**	**4+1**	**1 48**	**59·4**	***11.0 a.m. D.**
Paddington and Badminton	100	*b*‡3	1 44	57·8	*3.35 p.m. D.
Reading and Taunton	106¾	1	1 58	54·2	2.10 p.m. D.

* By slip coach. † Sunday trains. ‡ Including Sunday trains.

a 3.35 p.m. D, and 1.50 p.m. U, have conditional stops at Badminton. *b* 3.35 p.m. D, and 2.38 p.m. U, weekdays, are conditional stops only.

§ During the summer, when the 10.35 a.m. was running, the 10.30 a.m. did not serve Taunton by slip carriage.

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London and North Western Railway (Fifty-One Runs and One Slip Journey).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
Euston and Liverpool (Edge Hill) ..	192¼	1	3 28	55·45	6.0 p.m. D.
Euston and Warrington	182¼	2§	3 28	52·5	11.45 p.m. D.
Euston and Wilmslow	176¾	1	3 11	55·0	6.10 p.m. D.
Euston and Crewe	158	6§	2 51	55·5	*10.30 a.m. D.
Willesden and Crewe	152½	9§	2 46	54·8	9.56 a.m. U. Sundays, 6.16. p.m. U. Weekdays.
Crewe and Carlisle	141	8§	2 39	53·0	1.12 p.m. D.
Stoke and Willesden	140½	1	2 29	56·9	1.19 p.m. U.
Euston and Stafford	133½	3	2 22	56·0	5.30 p.m. D.
Stafford and Willesden	128	1	2 16	56·2	11.40 a.m. U.
Euston and Rugeley	124¼	†1	2 15	55·2	2.40 p.m. D.
Warrington and Carlisle..	116¾	2§	2 23	50·0	3.21 a.m. D.
Euston and Birmingham	113	11	2 0	56·5	All non-stop trains.
Willesden and Birmingham	**107½**	**2‡**	**1 53**	**57·0**	**5.32 p.m. D‡, and 11.30 a.m. U.‡**
Crewe and Holyhead	105¾	3§	2 4	51·4	2.0 a.m. U.
Wigan and Carlisle	105	1	2 8	50·4	12.11 a.m. D.

* The 10.30 a.m. D from Euston calls at Crewe at 1.21 p.m. for division. If divided throughout, the respective sections run through to Edge Hill or Wilmslow without stop. † By slip carriage.
§ Including journeys during Sunday, some of which may be actually equivalents to weekday services.
‡ Sundays only.

Great Northern Railway (Fifteen Runs).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
York and Peterboro'	111¾	2§	2 13	50·4	3.45 a.m. U.§
King's Cross and Grantham	**105½**	**13§**	**1 57**	**53·7**	**5.30 p.m. D.**

§ Including runs during Sunday, some of which are actually equivalents to weekday services.

Midland Railway (Four Runs).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
London and Nottingham	123½	2	2 15	55·0	8.25 a.m. U.
Leeds and Carlisle	113	2‡	2 20	48·8	1.40 a.m. U. Sundays.

‡ Including Sunday trains, but omitting certain runs including conditional stops.

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North Eastern Railway (Six Runs).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
*Newcastle and Edinburgh	124½	6	2 18	54·1	11.14 a.m. D.

* East Coast Trains drawn by North Eastern Railway engines but between Berwick and Edinburgh on North British Railway. † Including trains during Sunday.

London and South Western Railway (One Run).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
Waterloo and Christchurch	104¼	1	1 58	53·0	2.0 p.m. D.

Caledonian Railway (Two Runs).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
Carlisle and Stirling	**117¾**	**2**	**2 25**	**49·6**	**2.20 a.m. D.**
Carlisle and Glasgow (Central)	102¼	2	2 10	47·0	6.5 a.m. D.

NOTE.—The down trains from Carlisle to Perth, Glasgow and Edinburgh usually stop at Beattock for taking water and for assistance. If assisted from Carlisle, a stop is made at the summit for detaching the pilot. Therefore the non-stop runs to Perth are generally only 111 or 101¼ miles, while those to Glasgow, Edinburgh and Stirling are under 100 miles in length. Certain trains also have conditional stops which, if not allowed for, add several other items to the list.

Great Central Railway (Two Runs).

Between	Miles.	No. of Runs.	Journey by Fastest Train.	Speed Miles per Hour of Fastest Train.	Fastest Train.
			H. M.		
Marylebone and Leicester *viâ* High Wycombe	107½	1	1 54	56·58	6.20 p.m. D.
Marylebone and Leicester *viâ* Aylesbury	**103**	**1**	**1 49**	**56·7**	**3.15 p.m. D.**

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New Locomotives on the Hull and Barnsley, Furness, and Great Northern of Ireland Railways.

NOTWITHSTANDING the necessarily adverse influence of the war upon new locomotive design and construction, or perhaps partly on account of the heavy traffic requirements now placed upon the home railways, several interesting classes possessing features of novelty have been recently placed in service.

In a new series of 0–6–0 goods engines built by Messrs. Kitson & Co , Ltd., for the Hull and Barnsley Railway, Mr. Matthew Stirling, Locomotive Superintendent, has developed his standard ordinary goods class by equipping them with Schmidt superheating apparatus of a design including special features. Leading particulars correspond generally with older engines already in service, including Mr. Stirling's characteristic domeless boiler; but cylinders are increased from 18 in. diameter to 19 in., and while the use of slide valves is continued, they are of balanced type, exhausting through the back, and working above instead of between the cylinders. Allan straight-link valve gear is employed, with rocking-shaft transmission.

The first ten of the new engines—five built by the Yorkshire Engine Company and five by Kitson & Co.—use saturated steam, though, except for the superheating apparatus, they include the same developmental features. These have been followed by the five superheater engines now more particularly under notice.

As the engines are designed for heavy goods traffic, including a good deal of shunting and intermediate work, the superheater is so designed that steam always has access to the superheater. The regulator is on the superheated steam side of the header, actuated by a rod passing through the main steam pipe which extends horizontally from end to end of the boiler, being perforated for part of its length to collect steam. Instead of being placed in vertical rows as usual, the large boiler tubes for the superheater elements are arranged in rows slightly inclined to the vertical, thereby allowing of the connections being so arranged that any element can be removed, if need be, without requiring the removal of any other.

Leading dimensions are as follows :—

Cylinders	19 in. x 26 in.
Coupled wheels	5 ft.
Wheelbase	17 ft.
Steam pressure	170 lbs.
Tubes	18 (5¼in.)—133 (1¾in.)
Length between tube plates	11 ft. 4¾ in.
Heating surface, tubes ..	276—692 sq. ft.
,, ,, firebox ..	132 ,,
,, ,, superheater	217 ,,
,, ,, total ..	1,317 ,,
Grate area	19·6 sq. ft.
Coal capacity, tender ..	5 tons.
Water capacity ,, ..	3,500 galls.

Mr. W. F. Pettigrew, Locomotive Superintendent, has designed, and Messrs. Kitson & Co. have built, some new tank engines for use on the Furness Railway of interesting classes. Two are of the 4–4–2 type, the first with this wheel arrangement on this railway, and are intended more particularly for working passenger trains on the Lakeside, Coniston and Kendal branches during the period of heavy summer pressure. There are also two 0–6–0 tank engines for work at Barrow Docks, and on mineral and general traffic. Both classes have Ross "pop" safety valves, Detroit lubricators, Gresham & Craven injectors, a Davies & Metcalfe exhaust steam injector, and equipment for steam heating. The regulator is of Lockyer's double-beat equilibrium pattern.

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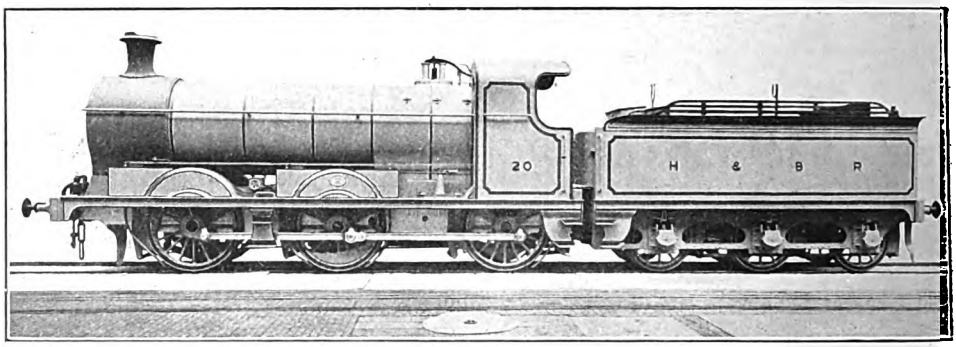


MR. M. STIRLING'S SUPERHEATER GOODS ENGINE: HULL AND BARNSLEY RAILWAY.

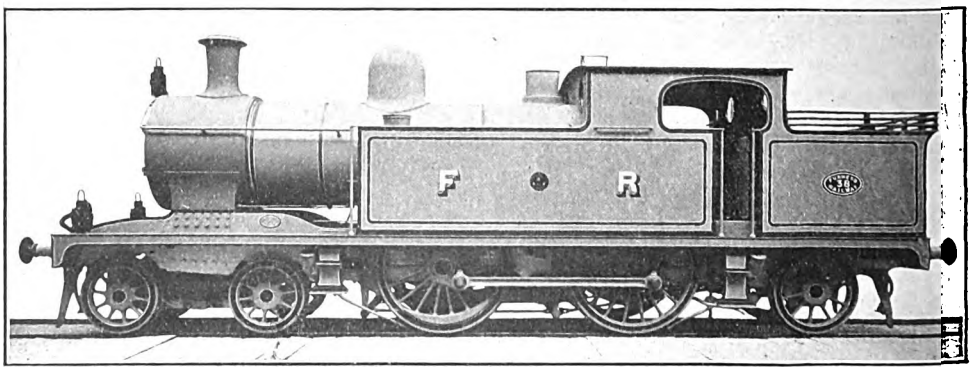
Leading dimensions of the 4–4–2 class (Nos. 38 and 39) are :—

Cylinders (inside)	17½ in. x 24 in.
Coupled wheels	5 ft. 8 in. diam.
Bogie wheels	3 ft. 2 in. „
Radial wheels	3 ft. 8½ in. „
Total wheelbase	29 ft. 0½ in.
Coupled wheelbase	8 ft.
Working pressure	160 lbs.
Heating surface, tubes	982 sq. ft.
„ „ firebox.. ..	88 „
„ „ total	1,070 „
Grate area	15·4 „
Capacity of tanks, coal	3 tons.
„ „ water ..	1,750 galls.
Total length over buffers ..	38 ft. 4½ in.
„ weight in working order ..	59 tons 10 cwt.

The 0–6–0 tank engines, Nos. 51 and 52, have 4 ft. 7½ in. coupled wheels, and the wheelbase is 15 ft. Coal capacity is 2·25 tons, water capacity 1,100 galls., total length over buffers 30 ft. 8½ in., and weight in working order 47 tons 10 cwt. Other dimensions correspond with those of the passenger class, the boiler and other parts being of the same dimensions.

Messrs. Beyer, Peacock & Company, Ltd., Manchester, have built for the Great Northern Railway of Ireland, to the designs of Mr. Geo. T. Glover, M.Inst.C.E., Locomotive Engineer, five new 4–4–0 locomotives intended primarily for the work of the northern section, from Dundalk to Enniskillen, Bundoran and Omagh, a stretch of 123 miles on which the train service usually consists of comparatively light loads, but on which there are numerous stops and many stretches of gradient of 1 in 80, 1 in 84, 1 in 90, etc., interspersed with sharp curves.

Owing to permanent way and other considerations, the maximum axle load is restricted to 14 tons 15 cwt. over this section, and these locomotives were, therefore, built with a small boiler, but with standard parts and main frames suitable for a large size boiler, which can be fitted when the weight restrictions are removed in the course of years, by which time the original boilers may have reached the renewal period.



MR. W. F. PETTIGREW'S 4–4–2 PASSENGER TANK ENGINE: FURNESS RAILWAY.

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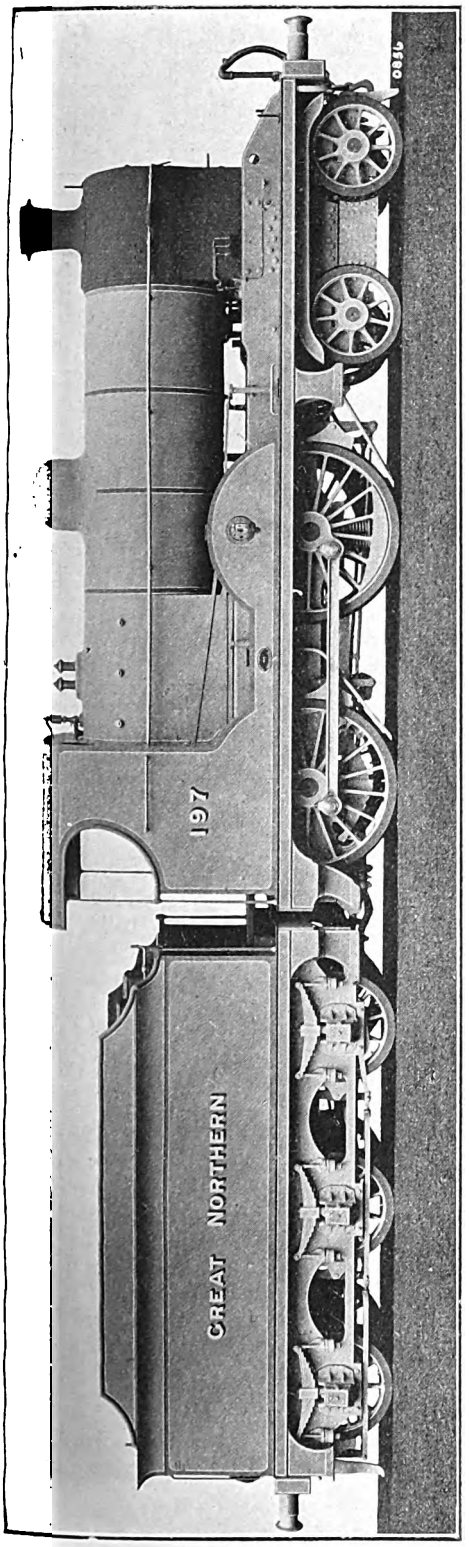

4-4-0 MIXED TRAFFIC LOCOMOTIVE FITTED WITH ROBINSON SUPERHEATER: GREAT NORTHERN RAILWAY OF IRELAND.

These five engines are fitted with the Robinson superheater, the first engines in Ireland to which this superheater has been applied. The connecting and coupling rods are of I-section, considerably lightened, so that the hammer-blow effect on the rails is considerably less than with the old type 6 ft. 6 in. four-coupled locomotives formerly in use. Wheels, motion, bogies, etc., are standard with the 4–4–2 non-superheater tank locomotives already in service, and the cylinders, boilers, etc., will interchange with those on some new 4–4–2 tanks to be fitted with Robinson superheaters, at present on order with Messrs. Nasymth, Wilson & Co. The boiler has 10 ft. 2 in. barrel, 4 ft. 3 in. in diameter, and contains 111 tubes $1\frac{3}{4}$ in. diameter, and 16 superheater tubes $5\frac{1}{4}$ in. diameter.

The following are the principal dimensions of the new 4–4–0 class :—

Gauge	5 ft. 3 in.
Cylinders	18 in. x 24 in.
Heating surface, tubes ..	757 sq. ft.
„ „ firebox ..	106 „
	863 „
„ „ superheater (inside)	193 „
„ „ total ..	1,056 „
Grate area	18·3 „
Working pressure	165 lbs. per sq. in.
Coupled wheels	5 ft. 9 in. diam.
Bogie „	3 ft. 2 in. „
Total wheelbase	20 ft. $4\frac{1}{2}$ in.
Weight in working order—	
On bogie wheels	15 tons 2 cwt.
On driving wheels ..	14 tons 14 cwt.
On trailing wheels ..	14 tons 10 cwt.
Total	44 tons 6 cwt.
Tender—	
Water capacity	2,500 galls.
Coal „	4 tons.
Diameter of wheels ..	3 ft. $7\frac{1}{2}$ in.
Wheelbase	12 ft.
Weight in working order	30 tons 11 cwt.
Total weight engine and tender	74 tons 17 cwt.

On this railway further 4–4–0 main line locomotives of the "Carrantuohill" class, illustrated by a colour plate in the RAILWAY MAGAZINE for September, 1913, have been placed in service, but these, as also other locomotives as they come in for attention, are painted black and lined out in red, the same as the goods engines. The result is perhaps not quite so attractive as the green for so long characteristic of the engines of this line, but is satisfactory in practice.

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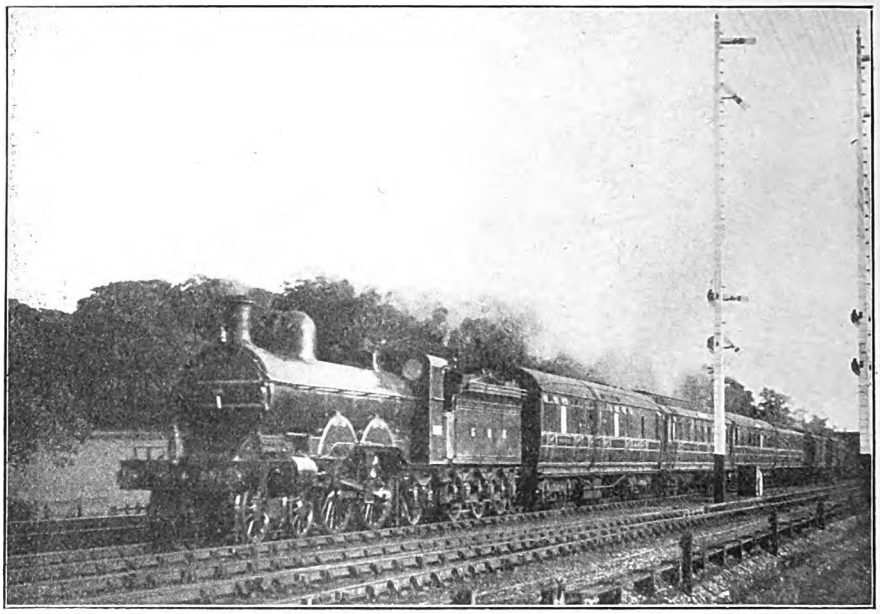

Photo] [*C. Laundy.*

GREAT NORTHERN RAILWAY.

4.20 p.m. *ex*-King's Cross near Hadley Wood; 4–4–2 locomotive No. 990, *Henry Oakley.*

[This view introduces a signalling problem, the "distant" signals being still "off," while the "home" ones are "on." The photograph was evidently taken during the second or two which may sometimes elapse between the movements of the respective arms. Ed., R.M.]

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

AS promised in my last article, I am giving a table showing the proportion of adhesion weight to total weight in the case of all the 48 express locomotives included in our previous discussions on superheater locomotive proportions. The provision of a superheater, beyond slightly increasing the weight of the engine, obviously does not affect the adhesion question, and consequently there is but little difference between the averages shown in this table, and the averages of the table of non-superheater locomotive dimensions and proportions which appeared in the March, 1911, RAILWAY MAGAZINE. Owing to the improved design of modern permanent way, however, and the gradual renewal and strengthening of underline bridgework, the permissible maximum axle-loads have slightly increased. For example, the average adhesion weight of 4–4–0 engines has risen from 35·3 to 37·0 tons (the figure would be 37·6 tons but for the inclusion of the light 4–4–0 engines of the Lancashire and Yorkshire and North Staffordshire Railways); from 36·8 to 37·8 tons in the case of the "Atlantics"; and from 52·5 to 53 tons in that of the 4–6–0 engines, both express and mixed traffic types included. It is rather interesting to recollect that the average adhesion weight of the "single" engines given in the previous table worked out at 18·3 tons, whereas the whole of the four-coupled engines here detailed give an average of 37·4 tons, and the six-coupled engines of 53·1 tons. These figures represent increases of 104 and 190 per cent. respectively, the adhesion weight being thus a little more than doubled in the case of two axles coupled, and a little less than trebled in that of three-coupled axles, the slight reduction in the latter instance being due to the great concentration of weight on a short wheelbase.

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Certain of the figures in the tables are worthy of remark. The maximum weight on four-coupled wheels may be taken as about 40 tons (the only engines in Great Britain exceeding this figure, so far as I am aware, are the large R1 class of the North Eastern Railway, with 42 tons on the driving wheels); the North Eastern Railway "Atlantics," the large Glasgow and South Western and Great Central 4–4–0 engines, the re-built Midland 4–4–0's, and the 4–4–4 North Eastern and 2–4–2 Lancashire and Yorkshire tanks all have adhesion weights closely approaching this figure. In the Midland engine the proportion of total weight available for adhesion is unusually high, amounting to no less than 75 per cent., so that a weight of only 13·6 tons rests upon the bogie. With other 4–4–0 engines the proportion is fairly consistent, not varying more than from 62 to 69 per cent. The Lancashire and Yorkshire 2–4–2 superheater tank type is, I should imagine, the longest and heaviest locomotive ever placed upon eight wheels, the total weight of these engines being only 3½ tons short of that of the large 4–4–2 North Staffordshire tanks. Among six-coupled express engines the 4–6–2, *The Great Bear*, of the Great Western Railway, is the only one to have a full 60 tons on the coupled axles, although the London and North Western "Claughton" class (with the Lancashire and Yorkshire four-cylinder 4–6–0 engines, which do not appear in the table) fairly closely approach this figure with 59 tons, and also the London and South Western Urie 4–6–0 engines with 58·6 tons on the driving wheels. At the other end of the scale we have the Great Eastern Railway 4–6–0 engines, with only 44 tons adhesion weight, this being a line on which the permanent way restrictions are particularly severe. These are very light engines for this wheel arrangement, weighing only 64 tons in all, so the percentage of adhesion to total weight works out as high as 69. The average adhesion in the case of

FOUR-COUPLED ENGINES.

Type.	Railway.	Typical Engine.			Weight.		
		No.	Name or Class.	Superheater employed.	Adhesion	Total.	Percentage.
4–4–2	G.N.R.	1452		Schmidt	36·0	69·5	52
"	L.B. & S.C.R.	421	(Class H2)	"	37·5	68·5	55
"	N.E.R.	722	(Class Z)	"	39·9	77·1	52
				Average	37·8	71·7	53
4–4–0	Caledonian R.	120		Robinson	38·0	59·0	64
"	G. & S.W.R.	131	(6 ft. Clas)	Drummond	39·9	61·9	63
"	G.C.R.	429	*Sir Alexander Henderson*	Robinson	39·6	61·0	65
"	G.N.R.	51	(Class D1)	Schmidt	35·5	53·3	67
"	G.N.R. (I.)	174	*Carrantuohill*	"	34·0	52·1	65
"	G.S. & W.R.	341	*Sir William Goulding*	"	37·5	59·4	63
"	G.W.R.	3818	*County of Radnor*	Swindon	37·6	58·8	62
"	"	4101	*Auricula*	"	35·7	53·3	67
"	L. & N.W.R.	2663	*George the Fifth*	Schmidt	38·3	59·9	64
"	L. & S.W.R.	464	(Re-built)	Eastleigh	37·6	59·2	63
"	L. & Y.R.	1112	(Re-built Class)	Schmidt	33·1	48·2	69
"	Midland R.	483	(Re-built Class)	"	39·8	53·4	75
"	N.B.R.	400	*The Dougal Crater*	"	37·9	57·3	66
"	N.S.R.	38		"	33·4	50·7	66
"	S.E. & C.R.	781		"	37·7	57·5	66
				Average	37·0	56·3	66
4–4–4 T	N.E.R.	2143	(Class D)	Schmidt	39·7	84·8	47
4–4–2 T	L.B. & S.C.R.	22	(Class I3)	"	38·0	74·0	51
"	G.W.R.	2221	(6 ft. 8½ in. Class)	Swindon	37·0	75·0	49
"	N.S.R.	8		Schmidt	37·7	70·0	54
2–4–2 T	L. & Y.R.	227		"	39·3	66·5	59
				Average	38·3	74·1	52

T—Tank Locomotives.

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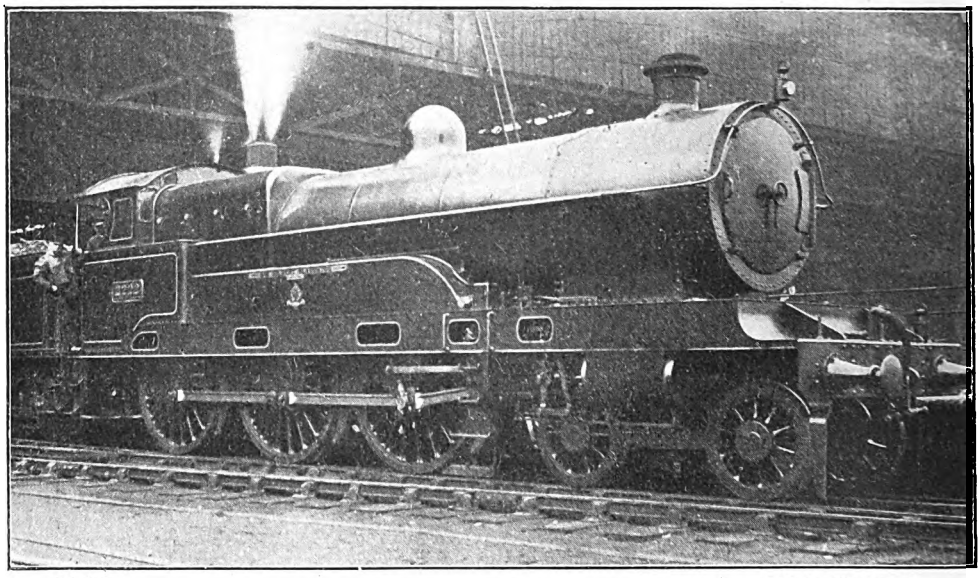
4–6–0 express engines is 73 per cent. of the total weight, as against 53 in that of the "Atlantics."

In further reference to the use of the "Atlantic" type of locomotive for express passenger work, and its value or efficiency as compared with the 4–4–0 and 4–6–0 wheel arrangement, I have recently turned up a correspondence that I had some years ago with a strong "Atlantic" supporter. These letters present the case for the "Atlantic" in so able and logical a fashion that I take the liberty of reproducing some extracts from them herewith. Certain of these points were mentioned briefly in the last issue, but others present a fresh aspect of the question. "The advantages which it is claimed may be obtained with the 'Atlantic' as compared with the 4–4–0 and 4–6–0 types," my friend writes, "are chiefly: a wide firebox, a very short rigid wheelbase, and moving parts whose effect is light."

"The wide firebox seems to be imperfectly understood in this country. It was at first regarded with suspicion and avoided by certain 'Atlantic' designers from fear of an increased repairs bill. As is now well known, the repairs to the wide firebox engines on the Great Northern Railway have proved below the normal. Special forging presses for the back-end plate, etc., are, however, required for its construction, but the capital cost of the plant when spread over, say, 100 engines is very slight. The shape of the box secures comparative freedom from expansion troubles and readily admits of tapering water spaces. The large grate area provides for a moderate and uniform rate of combustion and is at the same time exceptionally easy to fire well. To secure the same steam-raising capacity with the older pattern box, one of two courses is necessary. Either a much smaller grate area can be used and the coal burned per square foot per hour increased. The draught necessary for this results in incomplete combustion, and the fire is continually 'pulling into holes,' admitting cold air and causing leaky and cracked tube-plates. Or the grate area can be increased by using a very long box. Great difficulty is experienced with such boxes in maintaining an even temperature, and the firing involves such physical labour that many of the defects of the former expedient reappear on a long run. If the grate be deep, the difficulty of good firing is accentuated, as brought out in the recent London and North Western Railway coal-burning experiments." In these trials, as may be remembered, an "Experiment" showed a decided economy over a "Precursor" in the matter of coal consumption, the former



Photo] [*W. H. Whitworth.*

LONDON AND NORTH WESTERN RAILWAY.

No. 2222, *Sir Gilbert Claughton* at London Road, Manchester. This engine now has the double safety valves as fitted to other locomotives of the class.

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having a shallow grate with an area of 25 sq. ft., and the latter a deep grate between the coupled axles, with an area of only 22·4 sq. ft.

Continuing, my correspondent remarks: "The feeling of confidence and comfort which a wide box inspires is appreciated by all classes of drivers and firemen on the Great Northern Railway. I have myself asked quite a number of enginemen about it, and without exception any who had been on the 251 class 'swore by' them, irrespective of the engine they were on at the time. And in this instance the men's opinion is borne out by facts, the big 'Atlantics' burning on the average 6 lbs. of coal less per mile than the smaller-boilered 990 class with ordinary fireboxes. Of course, the wide box is only required where it is desirable to have a grate area of 30 sq. ft. (which gives a box approximately square in plan) or over. For smaller grates it is clearly less advantageous." These advantages being proved and unquestioned, it is curious that only the Great Northern and the London, Brighton and South Coast Railways, out of the six lines using "Atlantics," have availed themselves of this essential benefit attaching to the 4–4–2 wheel arrangement. On the other hand, I think that my correspondent has taken an extreme view of the disadvantages of the ordinary or narrow firebox, which is, after all, employed on all but 104 of the engines at work in the British Isles. Moreover, it would be difficult to prove that the

SIX-COUPLED ENGINES.

Type.	Railway.	No.	Typical Engine. Name or Class.	Superheater employed.	Weight. Adhesion	Total.	Percentage.
					Tons.	Tons.	
4–6–2	G.W.R.	111	*The Great Bear*	Swindon	60·0	97·0	62
4–6–0	Caledonian R.	903	*Cardean*	Schmidt	55·8	74·3	75
,,	G. & S.W.R.	129		,,	49·9	67·3	74
,,	G.C.R.	423	*Sir Sam Fay*	Robinson	56·5	75·3	75
,,	G.E.R.	1500		Schmidt	44·0	64·0	69
,,	G.W.R.	4041	*Prince of Wales*	Swindon	55·4	75·6	73
,,	,,	2934	*Butleigh Court*	,,	50·2	72·0	70
,,	L. & N.W.R.	2222	*Sir Gilbert Claughton*	Schmidt	59·0	77·8	76
,,	,,	819	*Prince of Wales*	,,	46·8	66·3	71
,,	L. & S.W.R.	447	(6 ft. 7 in. Class)	Drummond	52·0	74·5	69
,,	,,	482	(6 ft. "Urie" Class)	Schmidt	58·6	79·1	74
				Average	52·8	72·6	73
4–6–0 M	Caledonian R.	179	(5 ft. 9 in. Class)	Robinson	51·3	68·5	75
,,	G.C.R.	4	*Glenalmond*	,,	55·5	74·5	74
,,	N.E.R.	782	(Class S2)	,,	53·3	70·7	75
				Average	53·4	71·2	75
2–6–0 M	Caledonian R.	37		Schmidt	46·0	54·3	85
,,	G.N.R.	1630	(Class H2)	,,	51·7	61·7	84
,,	,,	1640	(Class H3)	,,	53·4	63·7	84
,,	G.W.R.	4331		Swindon	52·6	62·0	85
,,	L.B. & S.C.R.	337		Robinson	55·0	63·5	87
				Average	51·7	61·0	85
4–6–4 T	L.B. & S.C.R.	372	*Charles C. Macrae*	Schmidt	56·5	98·3	57
,,	Mid. (L.T.S.)R.	2100		,,	54·0	90·0	60
4–6–2 T	G.C.R.	165		Robinson	54·0	86·0	63
,,	L. & N.W.R.	2667		Schmidt	44·0	77·0	57
,,	L.B. & S.C.R.	326	*Bessborough*	,,	56·0	86·0	65
2–6–2 T	G.W.R.	3121	(5 ft. 8 in. Class)	Swindon	54·1	75·5	72
				Average	53·1	85·5	62

M—Mixed Traffic Locomotives. T—Tank Locomotives.

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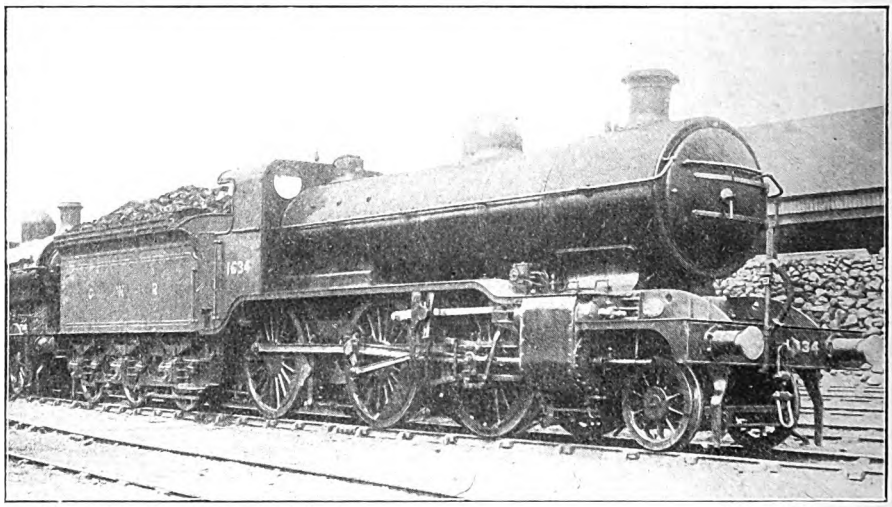
average express locomotive with narrow firebox, even on the longest non-stop runs, suffers consistently from the firebox troubles outlined in the foregoing paragraphs. Such difficulties are not experienced as a general rule unless the engine is being worked for long distances at the utmost limit of its tractive capacity.

Under his next "head" my correspondent proceeds: "The necessity for minimising the action of outside coupling and connecting rods does not yet appear to be universally respected. By experiments on two Stirling 2–4–0 engines, Mr. Ivatt found that a reduction of an inch or so in the throw of the side-rods had an appreciable effect in reducing the oscillation, and his 'Atlantics' have hence been designed with the short stroke of 24 in., with a coupling rod stroke of 23 in." The latter variation, it may be explained, is secured by the use of an eccentric crank-pin of special design. "The connecting rods are long in order to reduce their angular velocity and the thrust on the guides, both productive of rocking effect. Owing to the moderate cylinder dimensions the rods are also exceptionally light, the result of which is that the disturbing influence of the inevitable lack of balance is remarkably small. An increase in cylinder dimensions, especially length of stroke, and the use of very heavy connecting and coupling rods placed some distance outside the wheels, and therefore less well balanced, will result in an engine being subject to more persistent slipping than one in which care has been taken to reduce these defects, and secure a more even turning moment. Less power being thus absorbed in the engine, more is available at the drawbar of a Great Northern 'Atlantic,' particularly at high speeds, than is the case with other 'Atlantic' designs. Exactly how the loss due to side-rod oscillation is accounted for does not seem to be authoritatively cleared up, but it has been credibly assigned to flange friction occurring from the repeated pressure of the flanges against the rails owing to oscillation, thus producing continuously the well-known braking effect of curves. The shorter the coupled wheelbase, the much less is this 'curve loss' apparent, and a 4–6–0 (even with inside cylinders) suffers doubly, first from the longer fixed wheelbase, and secondly because the coupling rod oscillation is directly transmitted, through the springs, to a much larger proportion of the total weight of the engine and its disturbance is thus more marked. The disadvantages to the track and the repairs bill of six-coupled wheels, with the consequent heavy side-rods and long wheelbase exposed to their oscillating effect, are well-known."



Photo] [*W. J. Reynolds.*

GREAT NORTHERN RAILWAY.

2–6–0 locomotive No. 1634 (smaller boiler 1630 class) at King's Cross.

A good many points in the preceding paragraph require comment. In the first place it should be explained that the correspondence to which I have referred was based mainly on the merits or demerits of

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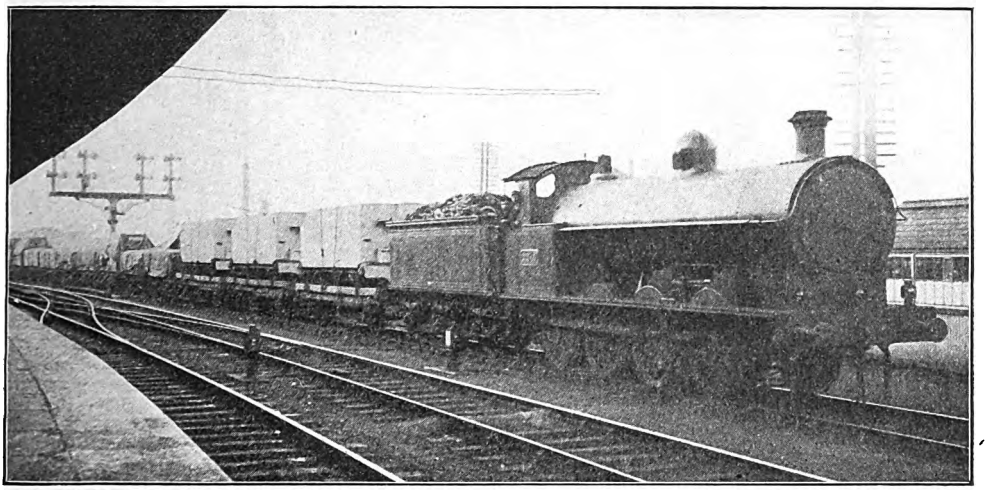
the standard Great Northern "Atlantics," as will be evident from the frequent references made to those engines, of which design my friend is a warm supporter. This will explain the stress that is laid on the advantages of a short stroke and moderate cylinder dimensions, as incorporated in the design in question. But these features can, if desirable, be applied to any locomotive type, and are not, therefore, the peculiar property of the 4–4–2 wheel arrangement. On the other hand, the Great Northern "Atlantics" are unique in these respects among British 4–4–2 designs, even the London, Brighton and South Coast "Atlantics," which closely correspond with the Great Northern engines in all details save these, having a stroke of 26 in. against 24 in., a cylinder diameter of 19 in. against 18¾ in. in the case of the non-superheater engines, and 21 in. against 20 in. in that of the more recent superheater batch. For it must be remembered that a short stroke and moderate cylinder dimensions are not an unmixed blessing. Every reduction in the length of stroke of a locomotive entails a corresponding curtailment of the leverage obtainable at the cranks, while a reduction in the diameter of the cylinders similarly reduces the area of the pistons.

This substantial loss of theoretical tractive effort need have no effect on the working of the engine at high speeds—indeed, the small-cylindered engine, with its light moving parts, probably has the advantage, as my correspondent points out, over its more nominally powerful large-cylindered sister under such circumstances, as witness the splendid work of the Great Northern "Atlantics" with moderate loads on high-speed schedules—but in starting from rest or in the negotiation of long adverse gradients with heavy loads the small-cylindered locomotive must be to some extent handicapped. Such a conclusion is not by any means a theoretical one only, so far as I am concerned, but is borne out by the comparison of runs made under similar conditions of loading and adverse grading on different lines. At some future date, which I will not venture to define too particularly, it is my intention to submit a comparison of average acceleration from rest and of uphill work behind different types of engines, under as nearly as possible identical running conditions, in the tabular form to which many readers will by now think me hopelessly addicted. It should be distinctly understood, of course, that the foregoing remarks apply to locomotives having, roughly, the same capacity for producing steam, and, moreover, a capacity sufficiently ample to supply the larger cylinders. The exact degree of amplitude is difficult to define, but it must again be emphasised that the cylinders of the Great Northern "Atlantics" are smaller in relation to the steam-producing capacity of the boiler than those of any other British



Photo] [*W. H. Whitworth.*

LONDON AND NORTH WESTERN RAILWAY.

No. 2246, 0–8–0 superheater class, at Stockport hauling train of locomotives (packed for shipment to the Uganda Railway), from the works of Messrs. Nasmyth, Wilson and Co., Ltd.

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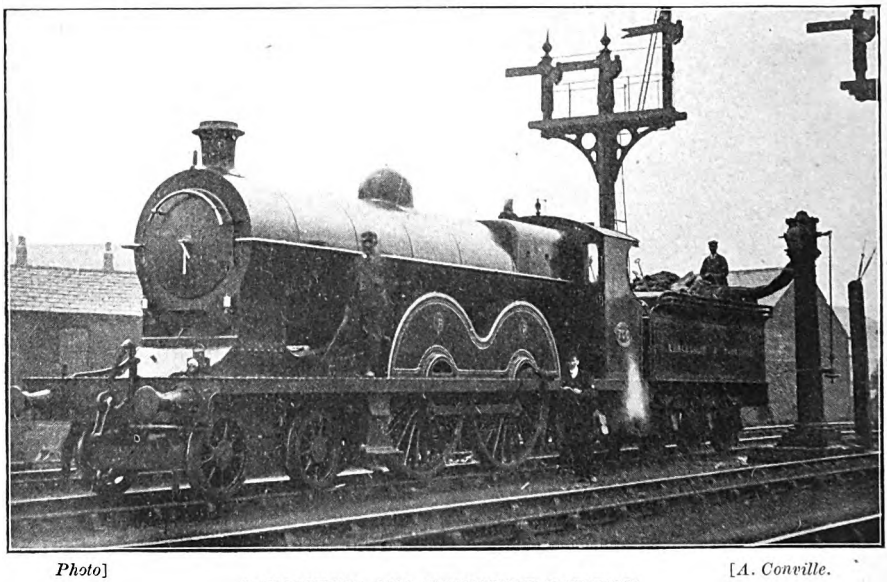
locomotive type, this unique constructional feature having formed the main basis of the discussion and criticism of the design in the past. It is thus a curious fact that the nominal tractive effort of the Great Northern "Atlantics" per ton of adhesion weight works out at almost exactly the same figure as the average of the 4–6–0 engines, which explains the greater immunity of the former from slipping as compared with other British "Atlantic" engines, but at the same time furnishes the reason of acceleration from rest and uphill work on long sustained grades that is at times decidedly mediocre. I hope to deal in tabular fashion with these proportions in subsequent issues, and so will not pursue this particular aspect of the case any further.

Finally, my friend refers to the loss of tractive power through side-rod oscillation in 4–6–0 engines, but it must be admitted that the evidence on this point is anything but conclusive. If this were a really serious loss, it becomes exceedingly difficult to explain how six-coupled engines can without difficulty maintain speeds up to 75 miles per hour with substantial loads on practically level lengths of road, as recorded in several instances in the last issue, and up to 90 miles per hour and even more on falling grades of by no means undue steepness. It is still more curious to note that the longest sustained record of 90 miles per hour that I possess—for 1¼ miles continuously—was made behind an engine with a stroke of 30 in., which, in conjunction with six-coupled wheels, should render so high a speed a practical impossibility on a grade of 1 in 175-254 owing to flange friction if my correspondent's theory had the serious results that he attributes to it. The only explanation of these apparent anomalies must be that modern methods of balancing, and more especially the use of multi-cylinder arrangements, have so reduced the lateral oscillation of 4–6–0 engines as to minimise the effect of flange friction. Some of the most comfortable footplate experiences I have ever enjoyed, from the smoothness of riding standpoint, have been on the 4-cylinder 6 ft. 7 in. 4–6–0 engines of the London and South Western Railway, even at the highest speeds, one of these engines having sustained a rate of 83·3 miles per hour for some miles on the moderate descent past Winchester without any undue oscillation. As to the disturbing effect of six-coupled wheels affecting the track, there is again no reliable evidence in support. On the contrary, it is equally notorious that the introduction of "Atlantic" locomotives, with very heavy moving parts and driving axle loads, on certain lines, has greatly enhanced the cost of track maintenance. I should be inclined myself to think that undue axle loads would adversely affect the permanent way in an even greater degree than the coupling of axles.



Photo] [*A. Conville.*

LANCASHIRE AND YORKSHIRE RAILWAY.
4-4-2 locomotive, No. 700, taking water.

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After so detailed an exposition of the advantages of the "Atlantic" type, it is, of course, only fitting that some further accounts of "Atlantic" performance should follow, and for this purpose I am dealing with some recent runs on the London, Brighton and South Coast Railway, which has not figured in these columns for some time past. The annexed table gives details of a number of runs on the 60-min. Brighton expresses, including the ever-popular "Southern Belle," and, in order further to illustrate the locomotive work, I have prepared a profile of the route, reproduced herewith, which I do not think has ever previously been given in the RAILWAY MAGAZINE. Of the runs detailed, I am indebted to correspondents for Nos. 2, 3, 4 and 6 in the down direction, and Nos. 7 and 10 in the up. Several of these runs have been described before, but I have tabulated them all as they furnish so interesting a comparison between the work of nearly all the modern London, Brighton and South Coast locomotive types, including the 4-4-2, 4-6-2, and 4-6-4 express tank engines, and the 4-4-0 and 4-4-2 tender types, both superheater and non-superheater. As the runs were all made on 60-min. trains, with the exception of No. 6, which has the 60-min.

L.B. & S.C.R. LONDON-BRIGHTON.

Distances from London.		Run No.		Schedule Times.	1	2	3	4	5	6
		Train			11 a.m.	6.35 p.m	5 p.m.	11 a.m.	11 a.m.	8.35 p.m.
		Engine No. ..			†25	†327	51	39	†425	†425
		„ Type ..			4-4-2 T	4-6-4 T	4-4-0	4-4-2	4-4-2	4-4-2
		Driver			—	Purser	—	Cox	Ingledew	Ingledew
		Load (tons).. ..			165	200	280	165	165	205
Miles.	Miles.			Mins.	M. S.	M. S.	M. S.	M. S.	M. S.	M. S.
0·0	—	Victoria	dep.	0	0.00 *	0.00	—	0.00 *	0.00	0.00
2·7	—	Clapham Junc. ..	pass	5	5.50	5.07 *	—	5.50	5.15	5.17
6·6	—	Streatham Common	„	—	11.25	11.49	—	—	10.05	10.07
—	0·0	London Bridge ..	dep.	0	—	—	0.00	—	—	—
—	2·7	New Cross	pass	5	—	—	5.24	—	—	—
—	5·5	Forest Hill	„	—	—	—	9.48	—	—	—
10·5	10·2	East Croydon ..	„	16	* 16.15	16.32	16.00	* 17.05	14.55 *	14.21
13·6	13·3	Purley	„	—	19.55 *	19.46	19.33 *	20.35 *	20.00 *	17.42
18·8	18·5	Quarry Box ..	„	25	26.40	25.24	26.25 *	—	26.45	23.53
21·9	21·6	Earlswood ..	„	29	30.15	27.58	30.27	‖31.55	29.55	26.59
25·9	25·6	Horley	„	—	34.10	31.17	34.34 *	36.20	33.40	30.58
29·6	29·3	Three Bridges ..	„	37	37.55	34.20	38.35	39.45	37.30	34.40
34·1	33·8	Balcombe	„	—	43.20	38.44	44.24	44.40	42.35	40.10
38·0	37·7	Hayward's Heath ..	„	—	47.10	41.56 *	47.40	48.00	46.15	44.37
41·2	40·9	Keymer Junc. ..	„	49	50.00	46.12	50.06	50.40	49.10	4.44
43·8	43·5	Hassocks	„	—	52.50	49.22	52.20	—	52.05	7.23 *
49·6	49·3	Preston Park ..	„	—	59.35	55.48	*	58.48	58.35	§14.11
50·9	50·6	Brighton	arr.	60	61.40	58.40	61.00	61.00	61.00	—
50·9	50·6	Net times (mins.) ..		60	59	54	57¼	56	58¼	‡44¼

* *Delays*—Run 1: Signals, Pouparts Jc. (slight); p.w.r., Windmill Bridge and Merstham Tunnel (severe).
Run 2: Signals, Wandsworth Common and Wivelsfield (both severe).
Run 3: Signals, Coulsdon (slight), and Three Bridges N. (severe); p.w.r., Quarry Box and Preston Park.
Run 4: Signals, Thornton Heath; p.w.r., Clapham Jc. and Coulsdon (both severe).
Run 5: Signals, from East Croydon to Coulsdon, severe.
Run 6: P.w.r., approaching Preston Park.

† Superheater engine; ‡ To Hayward's Heath; § Arrival time of slip portion; ‖ Slack to 40 m.p.h. at Earlswood Junc.

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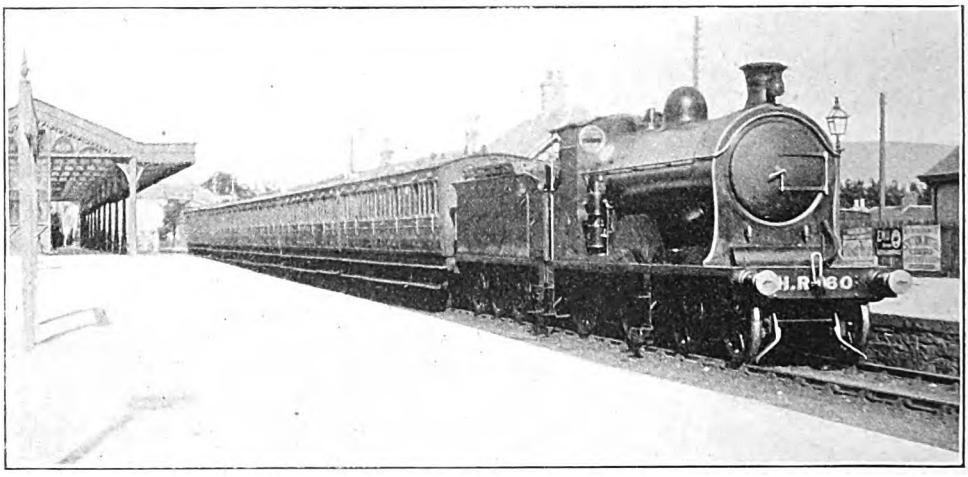
passing times to Three Bridges, and 10 min. thence to the stop at Hayward's Heath, they are tabulated in "locomotive" order—the tank engines first and the tender engines in an "ascending scale" afterwards.

The first run was the most uninteresting of the whole series, and was the only one, strange to relate, on which a 4–4–2 tank was employed. We were not seriously delayed by the earlier checks, and contrived to pass Croydon practically on time, but the slack through Merstham tunnel was very long and severe, and we passed Quarry nearly 1¾ min. late. In view of this late running the work beyond was poor, particularly uphill, speed falling to 45·5 miles per hour at Balcombe tunnel, and actually to 42·9 at Clayton—a very feeble exhibition. Maxima of 69·2 miles per hour at Horley and 68·1 at Hayward's Heath were not sufficient to "save the situation," with the result that no time was regained between Quarry and Brighton. In contrast to this run, the work of the large "Baltic" tank *Charles C. Macrae,* shown in the next column, was brilliant, and it is noteworthy that the times of this run on every section, excepting only those on which delays occurred and the sections immediately following them, were the fastest of the whole series. Clapham Junction was passed in just over 5 min., and a bad delay was then experienced at Wandsworth Common from the preceding 6.30 p.m. *ex*-Victoria. Despite this a speed of 53 miles per hour was attained on the rising grades beyond to Thornton Heath, and Croydon was passed only ½ min. behind time. Even with a load of 200 tons, the stiff booking of 9 min. from Croydon to Quarry presented no difficulties to Purser, who by first-class uphill work on the 1 in 264 and 165 to Merstham tunnel economised by 8 sec. on the time allowed. After this the pace became fast and furious. The tunnel was entered at 56 miles per hour, and left at 64; a speed of 75 miles per hour was attained at mile-post 20, and 81 at mile-post 24, while the minimum at Balcombe tunnel was as high as 60 miles per hour. Past Hayward's Heath a maximum speed of 78 miles per hour was attained, and the 19 miles from posts 19 to 38 were actually covered in 16 min. 26 sec., at an average of 69·5 miles per hour. Unfortunately the "motor" to Lewes was not quite clear of Keymer Junction, so that a bad signal delay was experienced in Folly Hill cutting, despite this, however, Brighton was reached well before time. Estimating carefully from the other runs in the table, it is clear that this journey could have been completed in 54 min., and the work performed bears a striking testimony to the capabilities of Mr. Billinton's "mammoth," both uphill and downhill.



Photo] [*Tom M. L. Neish.*

2.30 P.M. INVERNESS-PERTH EXPRESS (*via* FORRES) AT KINGUSSIE.

4–4–0 locomotive No. 60 *Ben Bhreac Mhor* (large "Ben" class).

Tender engines figure in the remainder of the down journeys. The 4–4–0 engines are capable of excellent work at times, and of this the run given in column 3, with a heavy load, is a striking example. A speed of 48·4 miles per hour was attained at New Cross, but the rate fell to 32·2 on Brockley bank.

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Before East Croydon, however, a maximum of 55·4 miles per hour was touched, and the speed had not fallen below 52·3 when a slight check was experienced at Coulsdon. A permanent way check followed at Quarry, and speed had risen to 69·2 miles per hour at Horley when a still further and more serious signal check—the prelude to crossing over from fast to slow roads—ensued at Three Bridges North. The driver now made a determined effort to pick up lost time, accelerating his engine to 46·4 miles per hour on the ascent to Balcombe, and then touching 83·3 on the descent past Hayward's Heath—the only occasion, my correspondent remarks, on which he has ever recorded so high a speed on the London, Brighton and South Coast Railway. At Clayton tunnel no lower rate than 63·5 miles per hour was reached, and a punctual arrival would probably have been effected but for a fourth check—for permanent way repairs—at Preston Park. This also was an exceedingly fine run.

The last three journeys were all behind "Atlantics." On No. 4, with a non-superheater engine of the first batch, a sequence of delays was experienced to Earlswood, but some fine running ensued. After Earlswood slack, the speed at Horley was not higher than 65·2 miles per hour, but the maximum beyond Hayward's Heath was 75, and at Preston Park 68·5 miles per hour. Good uphill work was performed also, speed not falling below 58·5 miles per hour at Balcombe and 60 at Clayton. Thus nearly 2 min. were regained between Earlswood and Brighton. No. 5, a journey of my own behind the superheater "Atlantic" No. 425, was smart from the start, but fell off sadly thereafter. Croydon was passed over a minute early, with the result that we "ran into signals" all the way to Coulsdon, and passed Quarry 1¾ min. late. After that we attained 69·2 miles per hour at both Horley and Hayward's Heath, with an intervening minimum of 51 at Clayton, but a slight slack at Keymer, where we were nearly on time, and sluggish running beyond sufficed to bring us into Brighton a minute late. The last run was much better than this. Ingledew first gratified his *penchant* for getting through Croydon in good time, his economy of over 1½ min. on schedule on this occasion evidencing smart initial work, and he continued to do well, speed being

L.B. & S.C.R. BRIGHTON–LONDON.

Distance.	Run No.		Schedule Times.	7	8	9	10
	Train			‡5 p.m.	12.20 p.m.	12.20 p.m.	‡5 p.m.
	Engine No.			†325	71	†422	†425
	Type			4-6-2 T	4-4-0	4-4-2	4-4-2
	Driver			J. Smith	Lingham	—	Ingledew
	Load (tons)			290	165	175	290
Miles.			Mins.	M. S.	M. S.	M. S.	M. S.
0·0	Brighton	dep.	0	0.00	0.00	0.00	0.00
0·7	Preston Park	pass	—	3.22	3.00	3.00	3.35
7·1	Hassocks	,,	—	10.20	10.30	10.30	10.47
9·7	Keymer Junction	,,	13	12.47	12.55	12.55	13.13
12·9	Hayward's Heath	,,	—	15.27	15.45	15.55	15.50
16·8	Balcombe	,,	—	19.40	19.55	20.20	19.51
21·3	Three Bridges	,,	25	24.44	24.40	25.10	24.31
25·0	Horley..	,,	—	27.48	27.45	28.15	27.31
29·0	Earlswood	,,	—	31.46	31.25	32.20	31.32
32·1	Quarry Box	,,	36	35.25	35.05	36.00	35.10
37·3	Purley	,,	—	40.55	40.25	*45.10	40.52
40·4	East Croydon	,,	45	*43.47	43.25	48.00	43.45
44·3	Streatham Common	,,	—	48.26	48.00	*53.00	48.03
48·2	Clapham Junction	,,	55	52.34	53.25	57.00	52.21
50·9	Victoria	arr.	60	57.38	58.20	61.15	56.30
50·9	Net times (mins.)		60	57	58¼	57	56½

* *Delays*—Run 7 : signals, South Croydon, slight.
Run 9 : p.w.r. right through Merstham Tunnel (3¾ mins. loss) and at Windmill Bridge.
‡ Sunday train. † Superheater engine.

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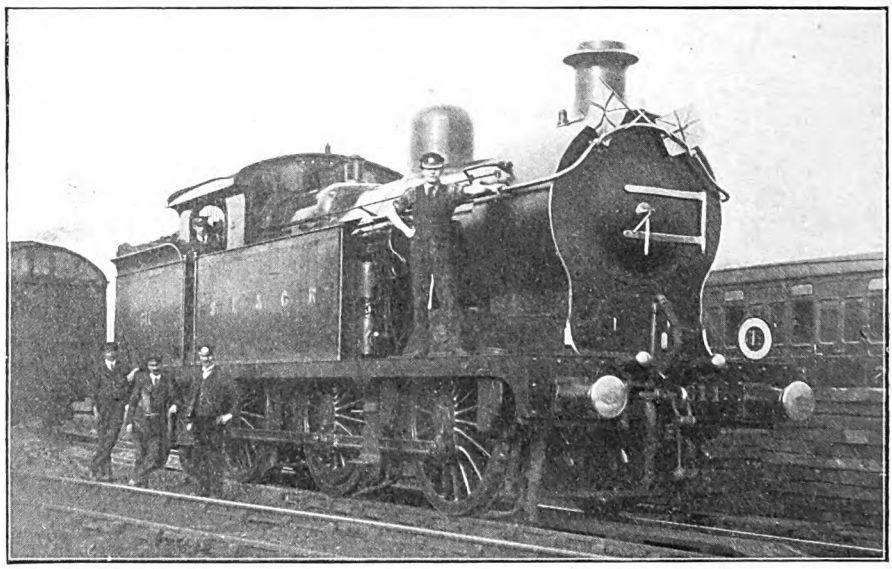
maintained at 55 miles per hour past Purley and not falling below 50 at Merstham tunnel. After this the engine was decidedly eased, but even then Hayward's Heath was reached nearly 2½ min. early. The remainder of the run also was very smartly performed, the 11·6 miles from Hayward's Heath to the arrival of the slip at Preston Park only taking 14 min. 11 sec.—a further economy of nearly a minute on schedule, despite a permanent way check outside Preston Park. Speed rose to 60 miles per hour at Wivelsfield, only fell to 55 at Clayton, the net time for the 11·6 miles being 13½ min. start to stop.

Remarkable consistency is shown on the up runs, and, in conformity with Brighton custom, close adherence to schedule times, the journeys being all uniformly good without any exceptional features. On No. 7 run the engine was the large 4–6–2 tank No. 325, *Abergavenny*, the "Southern Belle" having the full load of seven cars. A speed of 51·7 miles per hour was attained on the 1 in 264 rise to Clayton tunnel, and one of 71·4 on the descent to Wivelsfield; on Balcombe bank the minimum was 50 miles per hour, and on Quarry bank 46·9 (with a recovery to 47·3 on the final 1 in 206), the intervening maximum at Horley being 72·6 miles per hour. At Purley the somewhat unusual speed of 69·2 miles per hour was attained, and, despite a slight signal check at South Croydon, and very easy running thereafter, Victoria was reached nearly 2½ min. before time. No. 8 run was another very smart 4–4–0 journey with a "four-car" load. A speed of 50 miles per hour was attained on Clayton bank, and we then went well down to Wivelsfield, touching 73·8 miles per hour. A fall to 52·9 miles per hour was registered on Balcombe bank, after which followed a splendid "spurt," speed being maintained for a mile past Gatwick at 76·3 miles per hour. The minimum at Quarry was 49·5 miles per hour, and then, after touching 65·2 at Purley, and passing Croydon over 1½ min. early, Lingham ran very easily indeed into Victoria, arriving 1 min. 40 sec. before time.



Photo] [*W. J. Reynolds.*

SOUTH EASTERN AND CHATHAM RAILWAY.
0–6–4 superheater tank engine, No. 511

The last two runs were again behind superheater "Atlantics." Of these the No. 9 corresponded fairly closely with the times of No. 8 to Hayward's Heath, but fell off decidedly from there to Quarry. The maximum at Wivelsfield was 69·2 miles per hour and at Horley 73·8, the intermediate minimum up Balcombe bank being 51·7 miles per hour. On the ascent to Quarry speed had not fallen below 52·9 miles per hour when we were slacked for the relaying operations, which continued right through the tunnel, and lost us fully 3¾ min. A further check was experienced after Croydon,

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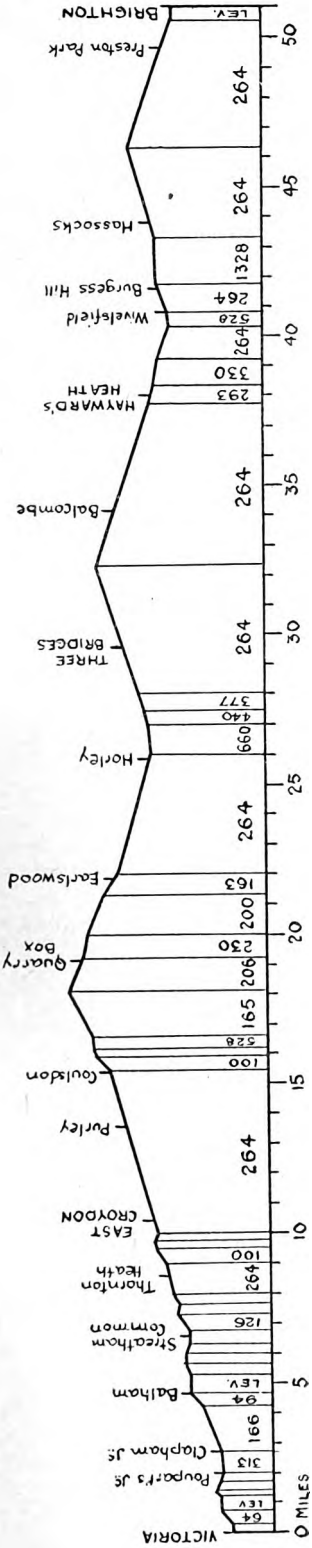
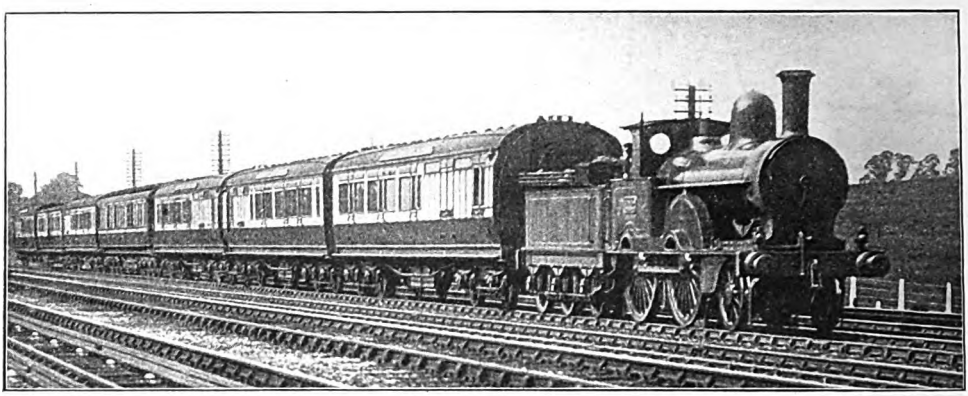

VICTORIA
0 MILES
Pouparts Jc
Clapham Jc
Balham
Streatham Common
Thornton Heath
EAST CROYDON
Purley
Coulsdon
Quarry Box
Earlswood
Horley
THREE BRIDGES
Balcombe
HAYWARD'S HEATH
Wivelsfield
Burgess Hill
Hassocks
Preston Park
BRIGHTON
LEV.
64
313
166
94
LEV.
125
1328
264
264
264



Photo] [*C. Laundy.*

LONDON AND NORTH WESTERN RAILWAY.

The "Sunny South Special," hauled by an old "Precedent" locomotive.

10 sec. from the start (20·9 miles) the rate had not fallen below 64·3. Up Tuxford bank we went at a minimum speed of 42·9 miles per hour, and Retford, 33·1 miles from Grantham, was passed in the excellent time of 35 min. 55 sec. At this point we ran into a most remarkable atmospheric disturbance, the sky being so black in every direction that the signals could only be seen with difficulty, and in consequence of this Hall ran very easily for some distance, the 17.4 miles from Retford to Doncaster taking 19 min. 35 sec. Even then we passed Doncaster in 55½ min., 2½ min. under time. Magnificent running followed, a speed of 60 miles per hour being maintained on the level or slightly undulating grades nearly all the way from Arksey to Selby, the 18·4 miles from Doncaster to Selby only taking 19 min. 5 sec. Selby, however, was passed at a lower speed than the now specified restriction, with the result that we were hampered on the rising grades beyond, and took 17 min. 20 sec. for the 13·8 miles from Selby to York. Despite the two slight delays, however, Hall had achieved the notable feat of running from Grantham to York, with a train of 375 tons, in 91 min. 55 sec.—5 min. 5 sec. under booked time. Normal speed from Retford to Doncaster and through Selby would have enabled us to complete the run easily in 90 min. It is worth noting that on this journey the stopping time at York was reduced from 12 to 6¼ min. while a North Eastern Railway 3-cylinder superheater "Atlantic" of class Z—No. 2196—succeeded in running from York to Darlington with this load in 50 min. 20 sec. (49 min. net)—2 min. 40 sec. under booked time. In this way no less than 13½ min. of the time lost south of Grantham was regained on the 127 miles between Grantham and Darlington, which represented very praiseworthy work on the part of all concerned.

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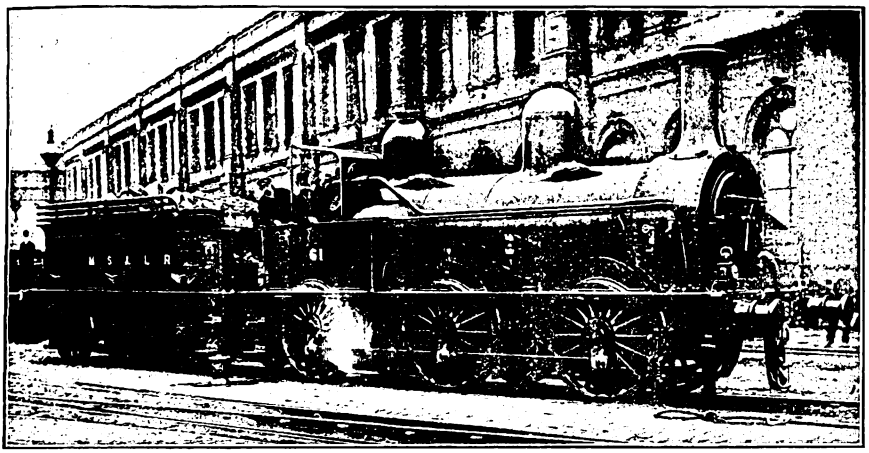

NO. 61, OLD MANCHESTER, SHEFFIELD AND LINCOLNSHIRE GOODS ENGINE WITH TWO DOMES.

Locomotive and Train Working in the latter part of the 19th Century.

THE MANCHESTER, SHEFFIELD AND LINCOLNSHIRE RAILWAY. [No. II.]

(*Continued from page* 131, *August*, 1915.)

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

TURNING now to the Eastern section of the Manchester, Sheffield and Lincolnshire main line, from Retford to Grimsby, we are, insofar as express services are concerned, confronted with another version of the "Snakes in Ireland" legend. Of daily express services there were none, but there was one bi-weekly boat train express which left Retford on Wednesdays and Saturdays only at 2.40 p.m., and ran to Grimsby Town station, where it was due at 3.43 p.m. without a stop (45 miles)—speed 42·9 miles per hour. This train was generally run by the Retford 4–4–0 engines Nos. 433 and 434, behind which I travelled on it on several occasions. All other trains stopped at nearly all stations, and, moreover, made New Holland and not Grimsby their objective.

It is curious to observe at this date that, although Grimsby is always stated to have been made by the Manchester, Sheffield and Lincolnshire Railway—and perhaps truly so—yet for a long time there was hardly any town of its size which was so badly served by passenger trains. Grimsby was an excellent place for the export of coal, and the import of fish, and it also had its uses on Wednesdays and Saturdays as the then usual passenger route from Lancashire and Yorkshire to Hamburg. But this ended the matter, for, strange to say, the old-time Manchester, Sheffield and Lincolnshire authorities always kept their eyes on Hull, with the result that in actual fact the main line trains ran not from Retford to Grimsby, but to New Holland.

I speak feelingly on the subject, for I can remember some monotonous periods, during which I "cooled my heels" at Ulceby Junction. There was a service of trains between Grimsby and New Holland, and if one happened to be a passenger for Retford or anywhere else on the main line, a change

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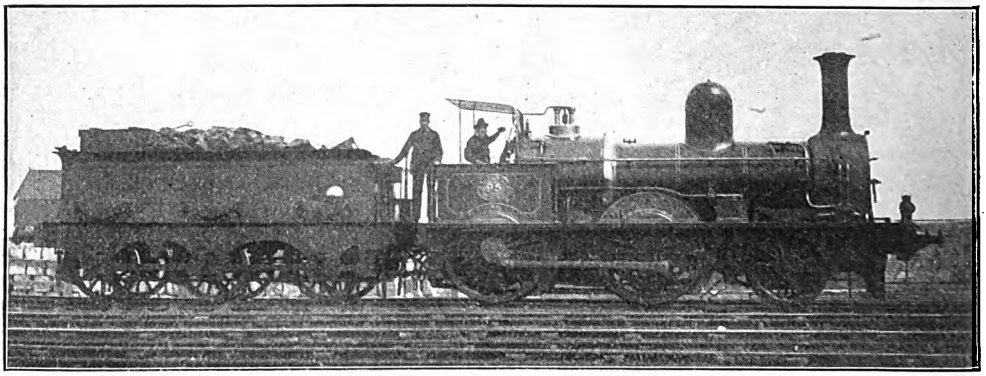
of trains had to be made at Ulceby Junction. This applied also to a passenger who wanted to get to Grimsby, unless he waited at Retford for the bi-weekly boat train. This boat train, and a Sunday morning excursion from Sheffield to Cleethorpes, were the only through passenger trains which used the present direct main line from Brocklesby to Habrough.

It followed, therefore, that New Holland was the station to which the main line passenger engines from Gorton, of the 423 class already noted ran through. Similarly No. 320 (2–4–0)*, stationed at New Holland, ran daily to Manchester for many years. This engine was the *Charles Dickens* of the Manchester, Sheffield and Lincolnshire Railway, and probably put in a longer mileage than any other engine at that time on the line. The 10 a.m. from New Holland actually omitted to stop at one or two stations between there and Retford, where it was due at 11.37. It eventuated at Manchester at 2.30 p.m.

Now this affection of the London Road authorities for Hull might be understood if the New Holland route and ferry had been the only means open to the Manchester, Sheffield and Lincolnshire Railway to get there. But this railway also operated what was, at that time, the only through service of trains from Lancashire and South Yorkshire to Hull (North Eastern Railway, Paragon station), for the London and North Western route *viâ* Leeds had no through trains, and the Lancashire and Yorkshire Railway attempted no competition whatever, as their route *viâ* Normanton and Milford Junction was extremely slow, and necessitated two changes.

The Manchester, Sheffield and Lincolnshire through trains from Liverpool (Central) to Hull travelled *viâ* Stockport and Godley Junction to Penistone, from which station some trains took the Barnsley–Mexborough route to Doncaster, and others the present Sheffield–Rotherham route. The Liverpool 4–4–0 engines Nos. 440 to 446 worked right through, and one of them was, I believe, stationed at Hull (North Eastern Railway) shed to work in the opposite direction. The 8.45 a.m. from Liverpool *viâ* Barnsley arrived at Hull at 1.30 p.m. and the 1.40 p.m. from Liverpool at 6.15 p.m. The 9.40 a.m. from Sheffield took 3 hr. 12 min. to Hull. The service, though not particularly exciting from a speed point of view, was always well patronised, and remains to this day, although none of the through trains have taken the Barnsley route for some years. It is one of the oldest established cross-country services existing.



2–4–0 LOCOMOTIVE NO. 95 (1869) WITH 5 FT. 6 IN. COUPLED WHEELS AND 17 IN. BY 22 IN. CYLINDERS (NO. 74 CLASS).

The remaining Lincolnshire services may be dismissed very shortly, in fact, they differ very little from those of to-day. These were the Sheffield–Lincoln trains, the Lincoln–Barnetby service, and finally the North Lincolnshire line from Doncaster to Barnetby. The latter was usually worked by four 2–4–0 engines, Nos. 212 to 215, with 5 ft. 6 in. wheels and 16 in. by 20 in. cylinders.* These, unlike the majority of the Manchester, Sheffield and Lincolnshire Railway engines, had inside frames only to all wheels, and were characterised by polished brass domes. In reality they were not designed for or built

* See illustration of No. 311, page 126, July number.

* See illustration of No. 215, page 130, July number.

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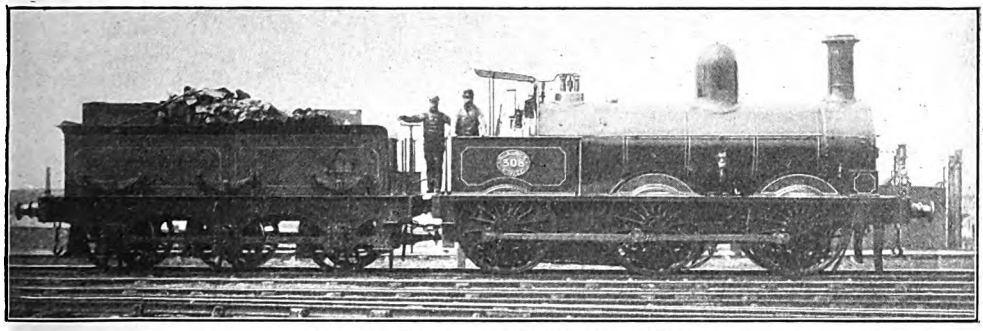
for the Manchester, Sheffield and Lincolnshire Railway at all, but had been constructed in 1865 by Messrs. Beyer, Peacock & Co. for the Sardinian Railways. They never went out, for what reason I do not know, but were purchased by the Manchester, Sheffield and Lincolnshire. During the latter years of their existence the polished brass domes were painted over.

At some date towards the end of the 'eighties, but exactly when I do not remember, Grimsby succeeded in getting itself on to the main line, *vice* New Holland deposed, and a better train service resulted. Two fast trains were put on in each direction, of which those from Retford to Grimsby took 65 and 63 min. respectively, with stops at Gainsboro' and Brigg. This 63-min. timing for the 45 miles was the same as that of the old boat train, which had the advantage of a non-stop run. These trains connected with the Great Northern at Retford, and may justly be given the title of "expresses."

The position occupied by the city of Lincoln has always been somewhat anomalous as regards the Manchester, Sheffield and Lincolnshire Railway. Although including the name of the county in its title, this railway has never had a home of its own in the principal city. Trains from Retford passed on to the Great Northern at Sykes Junction and obtained access to Lincoln (Great Northern) station by means of running powers for 7½ miles over this company's lines. On the other hand, the Lincoln and Barnetby branch trains arrived at and departed from the Midland station, for the Barnetby line is really a straight end-on extension of the Midland line from Nottingham to Lincoln. It is not so many years since the Barnetby trains were transferred to the Great Northern station at Lincoln by means of a short junction at the level crossing on the east side of Lincoln, close to the Great Northern and Great Eastern ticket platform, at which point the Barnetby line from the Midland station crosses the Great Northern line at a skew angle. Lincoln people have for several decades desired to do away with this and the other level crossing. They certainly are a nuisance—but then Lincoln without its level crossings would simply not be Lincoln! Just as well do away with the cathedral, the dean and chapter, and the "Stonebow," and transfer them all, say, to Pyewipe Junction (a new railway centre two miles from Lincoln), if iconoclastic alterations such as the abolition of the time-honoured railway crossings are really absolutely necessary.

But I must admit once meeting with another objector to the level crossings, in the person of the late Mr. Patrick Stirling, then Chief Locomotive Engineer of the Great Northern Railway at Doncaster, who, now a good many years ago, gave me his views about them. These I found were diametrically opposed to the opinions held by the citizens of Lincoln. The latter object to the frequent train service interfering with the road traffic, whereas Mr. Stirling held that there was too much road traffic, which seriously interfered with his company's coal trains, so that he could not use the engines he wanted. This shows that there are always two sides to a question. My own views have in general been those of Mr. Stirling, except on those occasions when I have had to stand five minutes or so waiting for the crossing gates to open, when, of course, I agreed wholly with the citizens of Lincoln.

In the summer of 1880 the Midland and North Eastern Railways opened the Swinton



0-6-0 GOODS LOCOMOTIVE NO. 308.

Built by Mr. Sacré, at Gorton Works, 1873. Coupled wheels, 5 ft. 3 in.; cylinders, 17 in. by 24 in.

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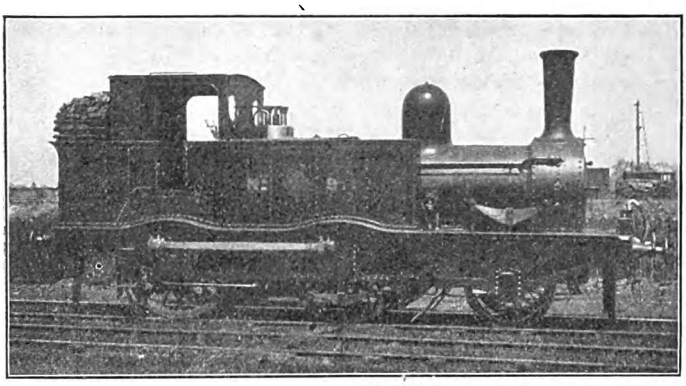
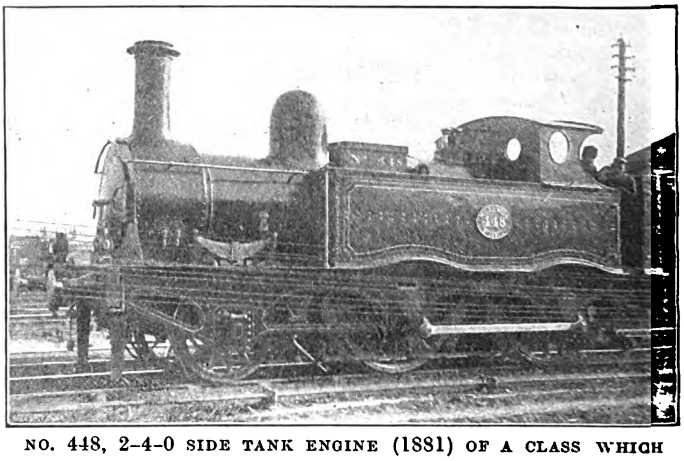


NO. 9, 2-4-0 TANK ENGINE (1863-1866), AFTER ALTERATION IN 1893 FROM BUNKER WELL TANK TO SIDE TANK DESIGN.

and Knottingley joint line, which gave the Midland access to York. The Manchester, Sheffield and Lincolnshire Railway Board, always alive to the main chance, had obtained running powers over this line, and although they did not use these to York (except for excursion trains) until the southern extension of the Great Central Railway was opened, they promptly in 1880 started a new fast local service of six trains each way per day between Sheffield and Leeds (Great Northern Railway, Central station) which competed directly with the Midland, whose joint metals provided them with the means. These trains stopped at Rotherham and Swinton, whence they ran up on to the Swinton and Knottingley joint line, which was used as far as Dearne Junction. This in turn gave them access to the Great Northern Railway and Manchester, Sheffield and Lincolnshire joint West Riding line to Wakefield (Westgate), which was the next stop, and thence they reached Leeds over the Great Northern with a stop at Holbeck Junction.

For two or three years these trains were almost invariably worked by the old 2-4-0 engines with 6 ft. wheels and 16 in. by 22 in. cylinders (180 class). The engines employed were Nos. 71, 85, 86, 152, 153, 258 to 262, 409 and 410, all stationed at Sheffield.* After 1884 the 4-4-0 engines Nos. 438 and 439 were frequently on this service, and also two of Mr. Sacré's 7 ft. 6 in. singles, Nos. 501 and 502, which ran daily to Leeds for a long period. These two engines had been quartered at Sheffield to be ready as pilots for the Grantham expresses in case anything happened to the Gorton engines. But their services in this direction were so very rarely, if ever, required, that they were put to work on the Leeds trains. One of the drivers on the Leeds service was the brother of George Ulyett, the celebrated Yorkshire batsman of the 'eighties.

A year or two afterwards the Manchester, Sheffield and Lincolnshire Railway made another bid for Leeds traffic, this time from Barnsley *viâ* Notton and Wakefield, and on this service almost always employed the 74 class, 2-4-0 engines with 5 ft. 6 in. wheels and 17 in. by 22 in. cylinders, built at Gorton in 1869. There were seven of the class, Nos. 64, 74, 75, 94, 95, 97, and 98, which were distinguished in that they were the only single-framed passenger engines, other than Nos. 212 to 215 already mentioned, which the Manchester, Sheffield and Lincolnshire Railway then had, except one nondescript, No. 89. With the exception of No. 64, which ran the New Holland and Barton branch, all the No. 74 class were stationed in the Barnsley district, whence they worked not only to Leeds, but also to Doncaster on



NO. 448, 2-4-0 SIDE TANK ENGINE (1881) OF A CLASS WHICH FOR MANY YEARS WORKED TRAINS ON THE MANCHESTER, SOUTH JUNCTION AND ALTRINCHAM JOINT RAILWAY.

* See illustration of No. 263, page 131, of the July number.

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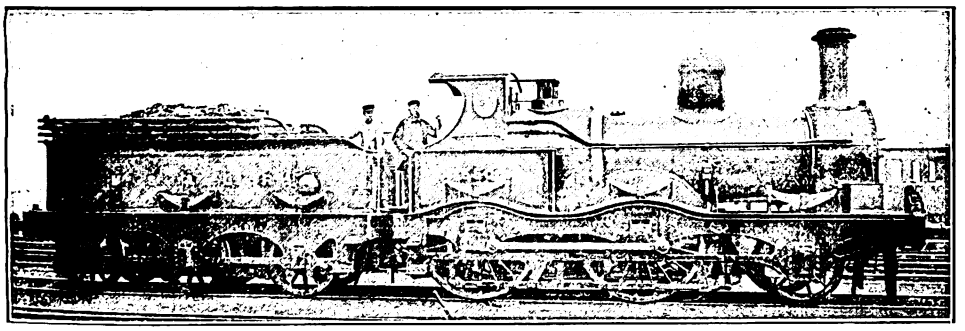
the one hand, and to Penistone on the other. These engines were broken up between 1901 and 1903 by Mr. Robinson.

As a kind of *quid pro quo* for the use made by the Manchester, Sheffield and Lincolnshire Railway of lines in which the Midland Railway was interested, this company made great use of the Manchester, Sheffield and Lincolnshire Railway main line for goods and excursion trains. Each night fast express goods trains between Bradford (Midland) and Liverpool, and between Sheffield (Midland) and Liverpool used the Manchester, Sheffield and Lincolnshire Railway between Barnsley and Godley Junction, and a Midland Leeds and Manchester goods train ran through to Ardwick. There were also a number of Midland excursion trains from Yorkshire stations to Liverpool, and at one time during the "'seventies" there was a regular fast passenger train service from Leeds (Midland) to Manchester (London Road). This was somewhat short-lived, for it did not pay, and was soon discontinued. When the Dore and Chinley line was opened in 1893 by the Midland, all their trains left the Manchester, Sheffield and Lincolnshire Railway line for the new road, though considerably further round from Bradford than the old Barnsley–Godley route.

The Manchester district was always a moving hive of local trains, and there were services to Guide Bridge and Stalybridge, Oldham, Hyde and Marple, Stockport, and to that busy North Derbyshire town, Glossop. All these services were worked to and from London Road station, so that the section of line to Guide Bridge, which possessed only one down and one up road for all trains until very recently, was at times strained to its utmost limit to accommodate the traffic. Prior to 1882 the Midland main line trains used Manchester, Sheffield and Lincolnshire Railway metals from Belle Vue Junction (Ashburys) into London Road station, and although they departed in that year to their new route into Central station, the Midland pressure was not relieved, for in conjunction with the Manchester, Sheffield and Lincolnshire Railway they afterwards worked a "roundabout" service of local trains from Manchester Central to London Road *viâ* Withington, Stockport, and Reddish. For some years half of these trains were worked by Manchester, Sheffield and Lincolnshire engines and stock, but afterwards the Midland worked their own section to Stockport, leaving a separate service from Stockport to London Road in the hands of the Manchester, Sheffield and Lincolnshire Railway. One feature of the Manchester, Sheffield and Lincolnshire Railway local train services, both in the Manchester and the Sheffield districts, was peculiar. Except on the Stockport services, until the year 1889 no tank engines were employed, and the whole of the numerous suburban services were conducted entirely by tender engines. The result was that half the trains at work were run "tender first," for it would have been obviously impossible to have turned the engines, or the engine crews would have put in almost as much mileage in walking round turntables as they ran upon the road. This absence of tank engines I could never understand, for the neighbouring Lancashire and Yorkshire Railway had set an example as large users of tank engines from the year 1855. Possibly Mr. Sacré wished to use up a considerable number of tender engines, of



Photo] [*Locomotive Publishing Co., Ltd.*

MR. SACRÉ'S LAST PASSENGER ENGINE, NO. 550 (CLASS 539–550, RENUMBERED 159–170), BUILT 1885.

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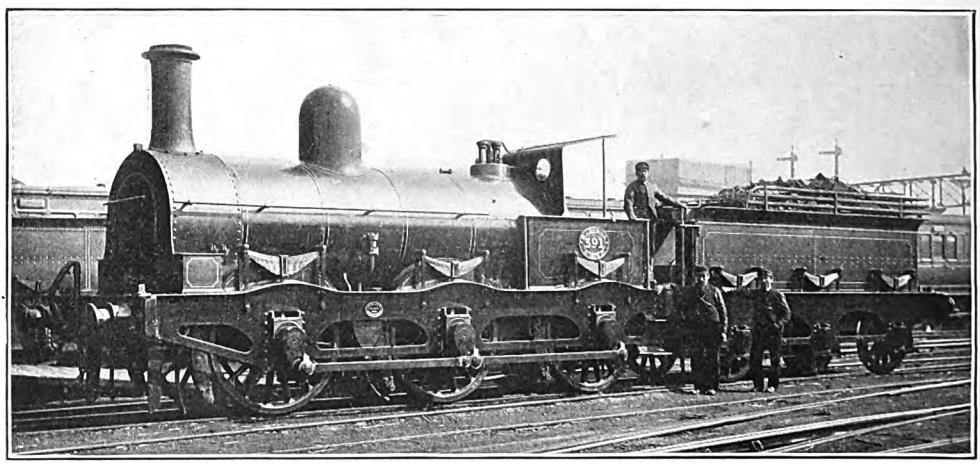
which two classes were very much in evidence. The first of these consisted of a fairly large number of 2–4–0 engines with 5 ft. 6 in. wheels and 15 in. by 20 in. cylinders (a few had 16 in. by 20 in.), and the other class consisted of the *ex* main line engines of the 180 class, which had 6 ft. wheels and 16 in. by 22 in. cylinders. Nearly all the above engines had been constructed between 1859 and 1868, and remained hard at work until they began to be relieved in 1889 to 1891 by Mr. Parker's 2–4–2 side tank engines.

The local service to Stockport was, however, generally worked by eight 2–4–0 well tank engines with 5 ft. 6 in. wheels and 15 in. by 20 in. cylinders. These engines, Nos. 9, 12, 20, 123, and 208 to 211 had been constructed at Gorton between 1860 and 1866 for the Manchester, South Junction and Altrincham joint line, but in 1880–1 they were replaced on that line by a larger class, leaving them to be utilised by the Manchester, Sheffield and Lincolnshire Railway on the Stockport services, although No. 123 was for a long time kept at Glossop. Historically they have an interest in that the details of their design in the Gorton drawing office had been carried through by the late Mr. S. W. Johnson, afterwards celebrated as the chief locomotive engineer of the Midland Railway. To the end of his career Mr. Johnson always took a paternal interest in these small engines, and on the occasion of his rare visits to Heaton Mersey joint engine shed, where most of them were stationed for the Stockport service, he invariably had a good look round one of them, to see how they were getting on.

In 1892–3 six of them were altered by the addition of side tanks, and the springs to the driving wheels were underhung, after which they appeared as now illustrated. They were scrapped about ten years ago. On the last occasion when I travelled behind No. 20, it was working the St. Helens branch from Lowton St. Mary's station. No. 12 was re-numbered 70 in 1893 and after the southern extension of the Great Central to Marylebone was opened, was employed for a considerable time on the Woodford and Banbury branch. Only six of them were converted to side tanks, for Nos. 123 and 210 remained in their original condition.



Photo] [*Locomotive Publishing Co., Ltd.*

NO. 391 OF MR. SACRÉ'S EXPRESS GOODS CLASS (1874–1877).
5 ft. 3 in. coupled wheels, 17 in. by 26 in. cylinders.

The Manchester, South Junction and Altrincham Railway, the joint working of which was vested in the London and North Western and Manchester, Sheffield and Lincolnshire Railways was, with the exception of the former Company's through trains, worked entirely by the locomotives of the Manchester, Sheffield and Lincolnshire Railway until about 1900, when the London and North Western Railway took over a joint share in providing the locomotive power. The carriage stock was and is the property of the Manchester, South Junction and Altrincham Railway, but was designed and constructed at Gorton. When the small 15 in. by 20 in. tank engines just described

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were removed from this line, their places were taken by a larger class of 2–4–0 side tanks with double frames, 5 ft. 6 in. drivers, and 16 in. by 24 in. cylinders. The first two of these, Nos. 23 and 24, were built in 1880 at Gorton, and six more, Nos. 447 to 452, followed in 1881. These eight engines bore the whole burden of the Manchester, South Junction and Altrincham joint passenger work between Manchester and Altrincham until about 1899, supplemented in later years by a few of the more modern 2-4-2 engines. They are now principally utilised as motor-coach engines. One of them works the Banbury Branch, and another is or was recently in the Aylesbury district.

The Cheshire Lines now demand some consideration. The working arrangements over this network of railways is similar to that on the Manchester, South Junction and Altrincham Railway, viz., that the Manchester, Sheffield and Lincolnshire Railway provided the locomotive power for the joint trains, but the carriage and wagon stock was the property of the Cheshire Lines Committee, though designed, built, and repaired at Gorton. From the time of the first inception of the joint committee, a service of express trains at high speeds has been maintained between Manchester and Liverpool. There were 12 hourly expresses in each direction which covered the distance of 34¼ miles in 45 min. with one intermediate stop at Warrington. The 15¾-mile run from Manchester to Warrington was performed in 18 min., a speed of 52·5 miles per hour. This was probably the smartest locomotive performance on any British railway for many years. The Warrington to Liverpool run of 18½ miles took 25 min., but the trains in the opposite direction took 23 min. for the Liverpool-Warrington run, and 20 min. for the Warrington-Manchester section. There was in 1880 only one through run, the 10.55 a.m. from Liverpool to Manchester on Thursdays only, which ran the 34 miles (*viâ* Warrington avoiding line) in 40 min.

Until 1883 all this high speed was performed by coupled engines with 6 ft. 3 in. and 6 ft. wheels. Several of the 311 class (6 ft. 3 in., 17 in. by 24 in.) Nos. 356 to 365 (6 ft., 16½ in. by 24 in.) with 130 lbs. pressure, both of the 2–4–0 type with double frames, and frequently the Liverpool 4–4–0 Nos. 440 to 446 did the work. I may say as the result of long observations that I do not think that there have ever existed any 6 ft. coupled engines on any line that were or are faster runners than Mr. Sacré's Manchester, Sheffield and Lincolnshire engines, with the possible exception of the Midland old 156 class (now Midland Railway Nos. 1 to 22) with 6 ft. 2½ in. wheels, a class of very similar double framed engines to those in question, and which were the only ones to my knowledge that could equal them as regards speed. The Manchester, Sheffield and Lincolnshire engines, which I have in mind are the 356, 44, and 539 (now 159B) series, most of which were on the Cheshire Lines, and I should also add to the list the 6 ft. 3 in. engines Nos. 311 to 320.

In 1882 the first 7 ft. 6 in. single, No. 399, as already recorded, made its appearance on the Manchester and Liverpool expresses, and this was followed in 1883 by other new engines of the same class Nos. 503 to 506, 509 and 510. About three years afterwards they were joined by Nos. 501 and 502, the two engines that had been at Sheffield, and at the end of 1887 the remaining three Nos. 500, 507 and 508 were also handed over from Gorton shed, when Mr. Parker's coupled engines took their places on the Grantham trains. In 1893, No. 399 became 104, and Nos. 500 to 510 were re-numbered 105 to 115, and for nearly 20 years they ran nearly the whole of the fast express service between Liverpool and Manchester. For "single" engines they were remarkably powerful, and could "get away" in excellent fashion with very heavy trains. Their fault of lateral unsteadiness at high speeds has already been mentioned, and I understand that at one time Mr. Robinson intended to alter them to have leading bogies, but the idea was abandoned. Beyond the minor alterations of longer smoke-boxes, new chimneys and new strap ends for the connecting rods they remained to the last in their original form. Like many other celebrated express engines of past decades, their last days were melancholy. Several were relegated to Annesley (Nottinghamshire) engine shed to run the "Bulwell Bus," otherwise known locally as the "Dido."

The "Dido" consists of one or two very old and extremely shabby-looking six-wheeled coaches employed in making short trips of six miles or so between Annesley shed and Bulwell Common for the convenience of the Great Central Railway drivers and workmen. The gentleman who "discovered" Annesley as a site for an engine shed, and who ought to have been awarded a F.R.G.S. for his pains, omitted to discover the ground whereon to build

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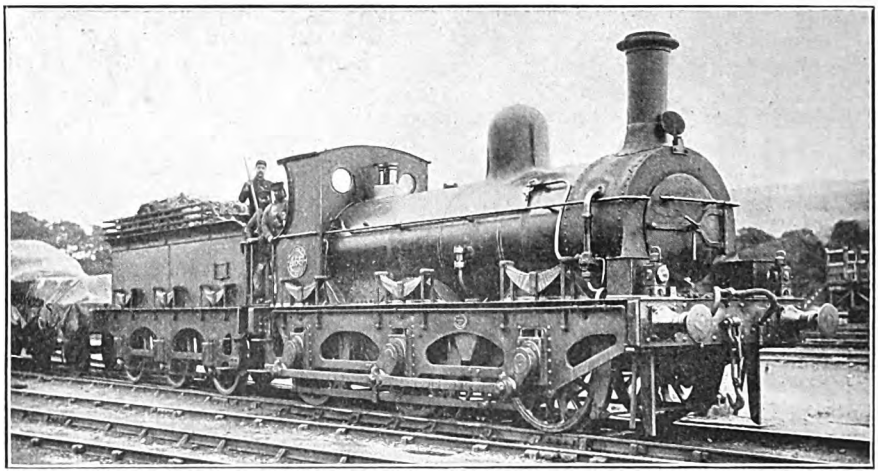
houses, etc., so that the men have to be transported in the "Dido" backwards and forwards to Bulwell and New Basford, on the outskirts of Nottingham. It was truly a very sad sight to see the old time 7 ft. 6 in. singles of the former Manchester-Grantham expresses doing this work, and after two or three years of it they were relegated to the scrap heap.

I may perhaps add a few instances of their work on the Cheshire Lines. The following is the log of the 3 p.m. from Manchester in 1886, load about 100 tons, engine No. 506.

		H. M. S.	M.P.H.
Manchester ..	dep.	3. 0. 0 ..	—
Post 4 ..	„	3. 5.40 ..	—
„ 5 ..	„	3. 6.40 ..	60
„ 6 ..	„	3. 7.39 ..	61

With the same engine No. 506 and about 140 tons, on one of the trains which stopped at Warrington, the 15¾ miles from Manchester were covered in 18 min. 33 sec., the maximum speed being 62·1 miles per hour at the 7th post. In this case with a fairly heavy train 33 sec. were dropped; 37 sec. were also dropped between Warrington and Liverpool on the 25-min. run, but this was not the fault of the engine, but was due to a bad slack all the way from the 19th to the 21st post. When the trains exceeded 120 tons it was somewhat difficult to keep exact time, *e.g.*, engine No. 505 with a train of 140 tons dropped 35 sec. from Liverpool to



Photo] [*Locomotive Publishing Co., Ltd.*

MR. SACRÉ'S HEAVY GOODS ENGINE NO. 466 (1880–1885), GENERALLY KNOWN AS THE "BULLDOGS."

Wheels, 4 ft. 9 in. diam. Cylinders, 17½ in. by 26 in.

Post 7 ..	dep.	3. 8.37 ..	62·1
„ 8 ..	„	3. 9.38 ..	59
„ 9 ..	„	3.10.39 ..	59
„ 10 ..	„	3.11.40 ..	59
„ 11 ..	„	3.12.41 ..	59
„ 12 ..	„	3.13.43 ..	58·1
„ 13 ..	„	3.14.41 ..	62·2
„ 15 ..	„	3.16.37 ..	62·2
„ 16 ..	„	3.17.39 ..	58·1
„ 17 ..	„	3.18.36 ..	63·2
„ 18 ..	„	3.19.34 ..	62·1
„ 19 ..	„	3.20.34 ..	60
„ 21 ..	„	3.22.36 ..	59
„ 26 ..	„	3.27.56 ..	56·3
„ 27† ..	„	3.29.10 ..	48·6†
„ 28 ..	„	3.30.17 ..	53·7
„ 29 ..	„	3.31.18 ..	59
„ 30 ..	„	3.32.18 ..	60
Liverpool ..	arr.	3.38.18*	due 3.40

† Relaying slack 26–27th post.

* Last mile into Liverpool very slow.

Warrington on a 23-min. schedule and 62 sec. on the 20-min. schedule from Warrington to Manchester.

I have not hitherto recorded that the 45-min. expresses which stopped at Warrington were supplemented early in the 'eighties by additional through 40-min. non-stop trains, of which those from the Manchester end left at 10 a.m. and 3 p.m., and three from Liverpool at 11, 3.30 and 4 p.m.

The following is the log of one of these which was worked by one of the 6 ft. coupled 2–4–0 engines, No. 542 (afterwards renumbered 162), with 16½ in. by 24 in. cylinders and double frames, a class to which I have previously referred (see illustration

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of No. 550, on page 217). Load about 100 tons :—

		H. M. S.	M.P.H.
Liverpool	dep.	10. 0. 8	—
Post 30	„	10. 6.29	—
„ 28	„	10. 8.35	57·1
„ 27	„	10. 9.44	52·2
„ 26*	„	10.10.58	* dead stop 25 sec. for signals.
„ 24	„	10.14.56	—
„ 23	„	10.16.10	48·6
„ 22	„	10.17.27	46·7
„ 21	„	10.18.36	52·2
„ 20	„	10.19.37	59
„ 19	„	10.20.35	62·1 } 7 miles at
„ 12	„	10.27. 7	64·3
„ 11	„	10.28.12	55·4
„ 10	„	10.29.20	52·9
„ 9	„	10.30.26	54·5
„ 8	„	10.31.29	57·1
„ 7	„	10.32.33	56·3
„ 6	„	10.33.37	56·3
„ 5	„	10.34.49	58·1
„ 4	„	10.35.42	57·1
„ 3	„	10.36.50	52·9
„ 2	„	10.37.55	55·4
Manchester	arr.	10.40.50	due 10.40

The above was really an excellent performance, for the train was only 42 sec. over the booked 40 min., in spite of a dead stop of 25 sec. at post 26. The sustained speed of the small 6 ft. coupled engine from the 20th to the 12th posts is worth noting.

Engine No. 542 (now No. 162B) belonged to the last batch of 12 engines—539 to 550—built by Mr. Sacré, all of which came out in 1885. Until this time the Manchester, Sheffield and Lincolnshire engines had been painted a medium green of a somewhat darker shade than the present colour, and were lined out with black bands and red and white lines. The underframes were of a red brown colour, and the brass number plates were all painted dark blue. The majority of the engines had weather-boards bent right over to the back of the footplate and supported by columns at the back of the side panels, but the 423 class (4–4–0), and all engines built from 1880 onwards had very neat cabs with oval side windows.

When the 539 class was built in 1885, the colour was changed to the most ghastly bilious sea-green that could be imagined, and as the lining out was reduced, the general effect was depressing in the extreme. Where that shade of green was invented I do not know; possibly some member of the locomotive department had been making investigations on the somewhat small 800-ton steamers plying between Grimsby and the Continent, on which the passengers were wont to exhibit various shades of it. Shortly after the appearance of the 539 class I was standing with a friend looking at one of them in London Road station, when after a few moments of silent observation, he suddenly dived into the small refreshment bar at the back of the buffer stops, for as he afterwards naïvely explained, "A 'Black and White' was absolutely necessary to take away the taste of that green." The Company also must have thought over the matter, for after a very short time the original colour was restored. In 1893, engines Nos. 539 to 550 were re-numbered 159 to 170, and several are now at work on the B or duplicate list. One or two, I regret to say, are now performing on the Annesley "Dido," mentioned previously.

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UTTOXETER STATION, NORTH STAFFORDSHIRE RAILWAY.

Platforms shown are used by Great Northern and some North Staffordshire trains; the footbridge gives access to the platforms used by Ashbourne and Macclesfield (Churnet Valley) trains.

The Railways of South Staffordshire.

III.—MIDLAND, NORTH STAFFORDSHIRE AND GREAT NORTHERN LINES.

By PHILIP F. GROVES.

THE Midland line between Tamworth and Burton (part of the West of England main line) requires but a few words. There are four stations—Elford, Croxall, Barton and Walton, and Branston. These stations have respectively 6, 5, 7, and 5 south-bound trains (to Tamworth), and a similar service in the reverse direction (except Branston which has only three Midland trains), the figures all being exclusive of London and North Western trains. Water-troughs are situated between Tamworth and Elford stations. Elford station was formerly called Haselour, the name being changed about 18 months ago. It may here be noted that between Repton and Derby, Midland metals are used by Midland Railway, London and North Western Railway and North Staffordshire Railway trains.

Burton-on-Trent has a very commodious and well-kept station, consisting of a spacious island platform, with the usual station buildings in the centre, and with bays at the north end for Great Northern and North Staffordshire trains. There are several miles of private railways in the town belonging to the numerous breweries there, most of the engines used thereon being neat little "Peckett" tank engines built by the well-known Bristol firm. Midland Railway shunting is performed by 0-6-0 side tanks, and by small 0-4-0 tanks with "stove-pipe" funnels. This latter is a feature not found on any other type of Midland engine.

It is interesting to note that at Burton there is still, or was until recently, employed an old 0-6-0 tank locomotive, No. 1608, taken over in 1895 from the Severn and Wye Railway, now jointly owned with the Great Western Railway and worked by the latter company. On the Severn and Wye line No. 1608 bore the name *Forester*.

The only remaining Midland line to be described is the Wolverhampton, Walsall, and Birmingham branch, in so far as it lies within Staffordshire. Leaving the London and North Western Railway at Wolverhampton East Junction, Heath Town Junction and the closed station are reached in rather more than half-a-mile. As explained above, London and North Western trains to and from Darlaston, Walsall, and Birmingham *viâ* Bescot exercise running

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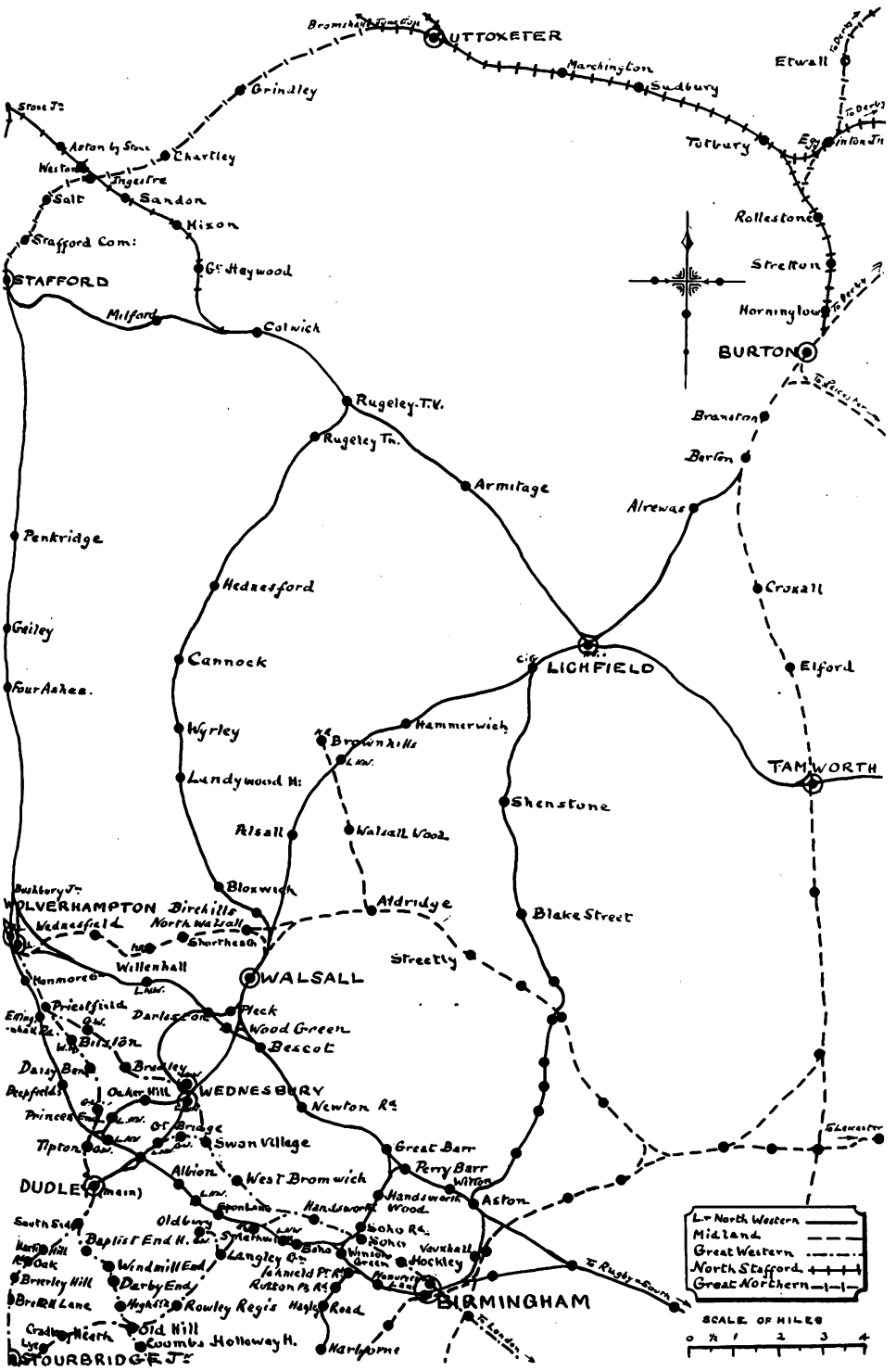

GENERAL MAP OF RAILWAYS SERVING SOUTH STAFFORDSHIRE.

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powers over the Midland Railway for this half-mile.

After passing over the London and North Western Bushbury-Portobello Junction goods line, Wednesfield station (1¼ miles from Heath Town) is reached, followed at a like distance by Willenhall (Midland Railway) station, which is about half-a-mile by road from the London and North Western station. The Great Western Railway has running powers for goods traffic between Heath Town Junction and Walsall over the Midland line, the two railways being connected by an exchange yard at the former place. Three Great Western goods trains are run in each direction daily, calling at Willenhall and Wednesfield, either regularly or conditionally.

Short Heath (Clark's Lane) and North Walsall stations are passed before joining the London and North Western Rugeley and Lichfield branches at Ryecroft Junction, about seven miles from Wolverhampton. The former station is used, as far as goods traffic is concerned, for trains from Wolverhampton only, but North Walsall and the other stations have a considerable goods traffic in both directions. Midland stations between Walsall and Wolverhampton have from 5 to 8 (mostly London and North Western) trains each way daily, North Walsall having 6, Short Heath 5, and Willenhall and Wednesfield 7 down and 8 up.

The Midland line from Walsall to Birmingham, soon after leaving Ryecroft Junction already referred to, is joined by a direct (goods and mineral only) line from North Walsall, enabling trains to run through from Wolverhampton and Willenhall (Midland Railway) to the Birmingham line without either reversing at Walsall or making use of the London and North Western line as previously explained in connection with the passenger trains. The Midland Railway goods yard and depôt at Walsall is situated south of the station, not far from Pleck East Junction.

Four freight trains each way daily use the North Walsall and Aldridge direct line, which crosses the London and North Western Rugeley and Lichfield branches. Aldridge station is three miles from Walsall, and is the junction for the Brownhills branch, five miles long. The daily passenger train service consists of only three trains each way, calling at the one intermediate station, Walsall Wood, but there are five trains on Saturdays. The branch extends for about two miles beyond Brownhills station, serving various collieries and brickworks *en route*, but passenger trains run only as far as Brownhills. The London and North Western Lichfield and Walsall line is crossed just short of Brownhills (Midland Railway) station. As stated above, a connection is made with the London and North Western at one of the collieries here. Two-and-a-half miles beyond Aldridge is Streetly station, and at the road bridge in this station the line passes into Warwickshire, its continuation being described in the RAILWAY MAGAZINE, September 1913. Fourteen trains each way run daily between Walsall and Streetly, calling at Aldridge, most of these being to or from Birmingham.

At Stafford may be seen the locomotives and stock of three railways, the London and North Western, Great Northern and North Staffordshire. How the Great Northern Railway reaches Stafford, where it has a small station of its own, in addition to the use of the London and North Western station there, will be mentioned later.

The North Staffordshire Railway enters Stafford, where it uses the London and North Western station, by means of a branch from Stoke-on-Trent. Trains on this branch exercise running powers over the London and North Western main line from Norton Bridge junction, about six miles north of Stafford. Between Norton Bridge and Stafford there is one intermediate station, Great Bridgeford, at which most of the eleven (twelve on Saturdays) North Staffordshire trains call for passengers to or from that company's line, though nearly all the services from Great Bridgeford to London and North Western stations are provided by that company's trains, though a few North Staffordshire Railway trains do call there for ordinary traffic. Curiously enough, the only train of either company which calls at Great Bridgeford at all on a Sunday is a North Staffordshire train from Stoke-on-Trent. Ten (three on Sundays) North Staffordshire Railway trains in each direction call at Norton Bridge daily.

From Stone Junction, situated on the North Staffordshire, Stoke and Stafford branch four miles before its junction with the London and North Western Railway at Norton Bridge, a branch, also belonging to the North Staffordshire Railway, runs to Colwich, on the London and North Western main line six miles south of Stafford. The North Staffordshire Railway has running powers over the London and North Western Railway from both Stafford and Colwich to

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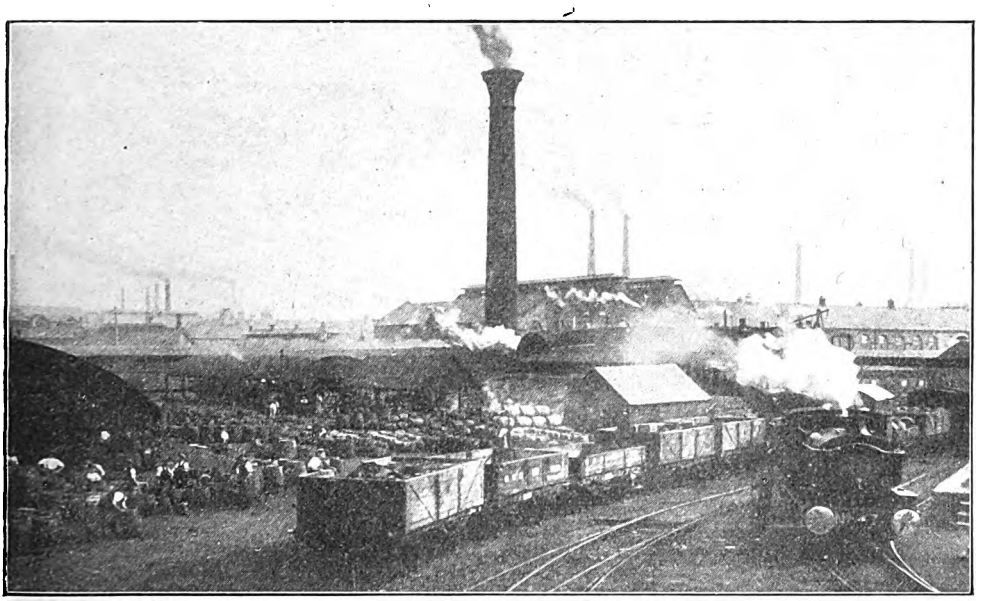
Birmingham *viâ* Wolverhampton and Walsall respectively, but these are seldom exercised beyond the two last named towns. North Staffordshire coaches, however, run through to Birmingham daily. The regular daily working of the North Staffordshire engines over the London and North Western Railway is as follows: 3.23 p.m. Colwich to Rugeley (arr. 3.28); 4.35 Rugeley to Walsall (arr. 5.17); 5.57 p.m. Walsall to Colwich and Stoke. North Staffordshire locomotives are also regular visitors to the Stafford and Wolverhampton line.

On the Stone and Colwich branch there are five intermediate stations, Aston-by-Stone, Sandon, Weston (Ingestre), Hixon, and Great Haywood. The last four are served by three trains and on Tuesdays and Saturdays only by an extra rail-motor in each direction. Aston-by-Stone has one extra train from and two to Stone daily.

It will be seen from this that the train service on this branch is not very frequent—in fact, no line in South Staffordshire has a smaller service. Two London and North Western expresses, however, which leave Euston at 12.15 and 4 p.m. daily use this branch *en route* for Manchester, with the return services. Whilst on North Staffordshire lines, which are entered at Colwich, the trains call at Stoke, Congleton, and Macclesfield, leaving the North Staffordshire Railway at the last mentioned place. The Great Northern Uttoxeter and Stafford line is crossed by the North Staffordshire Stone and Colwich branch near the former company's Ingestre and the latter's Weston stations, which are half-a-mile apart by road.

From Burton-on-Trent a branch of the North Staffordshire Railway runs to Marston Junction, east of Tutbury station on that company's main line from Derby (Midland station) to Uttoxeter, Stoke, and Crewe. The intermediate stations are Horninglow, Stretton and Clay Mills, and Rolleston-on-Dove, and between Tutbury (5½ miles from Burton) and Uttoxeter there are two intermediate stations, Sudbury and Marchington. Great Northern Railway trains from Burton to Derby and east thereof (Nottinghamshire and Lincolnshire section) exercise running powers over the North Staffordshire Railway from Burton to Dove Junction, north of Rolleston-on-Dove station, where they enter a spur which joins the North Staffordshire company's main line from Derby at Egginton Junction station, leaving North Staffordshire Railway metals finally at the east end of that station. Great Northern Railway working will be dealt with later. It will be seen that there is a triangle at whose vertices are situated Egginton, Dove, and Marston Junctions, the latter being where the branch from Burton joins the North Staffordshire Railway main line with a junction facing



VIEW IN THE YARD AT ALLSOPP'S COOPERAGE, BURTON-ON-TRENT.

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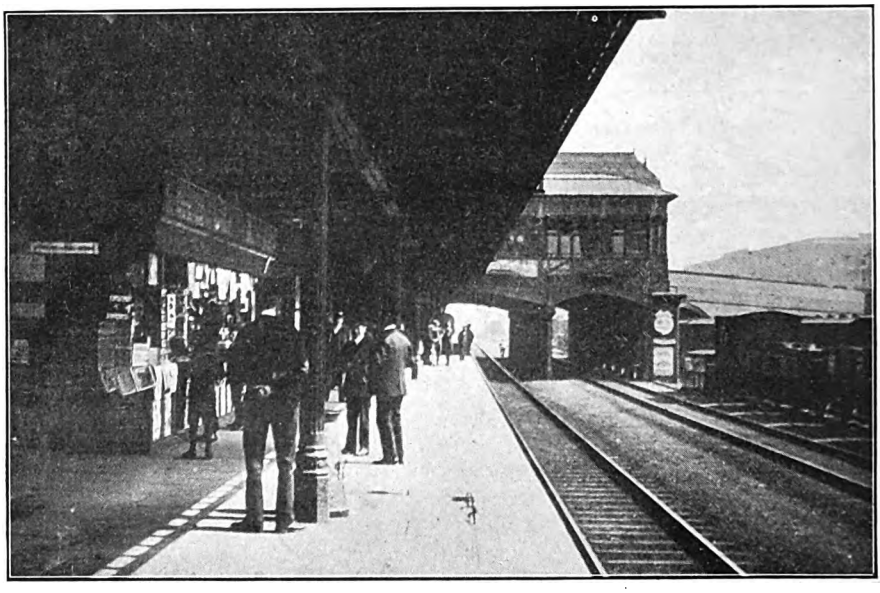
towards Uttoxeter. This will be made clearer by reference to the map.

North Staffordshire trains from Derby to Egginton, Uttoxeter, etc., leave Midland Railway metals at Willington junction, near the latter company's Repton station. The North Staffordshire Railway then runs for a short distance by itself before reaching Egginton Junction, where the Great Northern Railway is joined by a junction facing towards Uttoxeter, and left again at the other end of the station, where it forms a junction facing towards Derby. Continuing westwards from Egginton Junction over the North Staffordshire Railway main line, after being joined at Marston Junction by the branch from Burton, Tutbury station is reached, the distance from Egginton Junction being three miles, and from Derby (Midland) 11½ miles.

Nine main line trains in each direction call at Tutbury *en route* to or from Derby, about five in each direction calling at Egginton Junction. On the Tutbury–Burton North Staffordshire Railway branch there are ten up (to Burton) and nine down trains daily. Seven down and nine up call daily at all stations, the others being through London and North Western Railway expresses, though hauled on this section by North Staffordshire Railway locomotives, between Euston and Buxton *viâ* Ashbourne, which have been referred to in another place. These make conditional stops at certain stations, but such stops are so numerous in this district, as a glance at "Bradshaw" will show, that to detail them here would be tedious. Certain extra trains run between Burton and Tutbury on Saturdays.

Seven North Staffordshire Railway main line trains in each direction call at Sudbury, but only two up and four down at Marchington, though, as before stated, both places benefit by conditional stops.

Uttoxeter is distant 13¼ miles from Burton, and is a fairly important junction and North Staffordshire Railway locomotive depôt.



DOWN PLATFORM, BURTON-ON-TRENT.

Trains to and from seven different lines use this station, viz.:—

(1) North Staffordshire Railway trains to and from Derby *viâ* Tutbury.
(2) North Staffordshire Railway trains to and from Stoke and Crewe.
(3) North Staffordshire Railway trains to and from Burton *viâ* Tutbury.
(4) North Staffordshire Railway trains to and from Ashbourne branch.
(5) North Staffordshire Railway trains to and from Leek and Macclesfield direct line.
(6) Great Northern Railway trains from and to Derby, Nottingham, and Grantham, *viâ* Egginton and Tutbury.
(7) Great Northern Railway Stafford and Ingestre branch trains.

The second, fourth and fifth of these

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services are outside the scope of this article, whilst the first and third have already received attention, so that the Great Northern Railway train services alone remain to be described.

There are six trains daily in each direction between Derby, Egginton, Tutbury (10¾ miles from Derby by Great Northern Railway route), Uttoxeter and Stafford, mostly calling everywhere regularly, though in some cases at Sudbury and Marchington conditionally. These trains, of course, exercise running powers over the North Staffordshire Railway between Egginton and Uttoxeter, where they run on to a section of their own system otherwise isolated from the parent company's lines. There are five stations between Uttoxeter and Stafford (London and North Western Railway)—Grindley, Chartley, Ingestre, Salt, and Stafford (Common). All the six trains which run in each direction on week-days call at these stations. The distance is 15 miles, and the previously described North Staffordshire Colwich and Stone branch is crossed near Ingestre station.

Between Egginton and Burton there are ten down and nine (ten on Saturdays) up trains, some of which do not call at Stretton and Clay Mills—one being non-stop.

Railway and other Literature.

HALIFAX, A COMMERCIAL AND INDUSTRIAL CENTRE. An illustrated handbook under this title has been issued under the auspices of the Halifax Chamber of Commerce, Chamber of Trade and Advertising Club. It is edited by Mr. G. P. Wadsworth, and published by Sells, Ltd. The object of this book is to show what Halifax, in its varied activities, can offer to-day to the world of commerce; to put before those seeking a location for new works or an extension for old ones the many advantages of the district; and also to give to Halifax folk themselves an up-to-date book on the present position of their town. The volume has been divided into several sections. Following upon the introductory article on "The Town in Brief," appears Section I., "Representative Bodies," in which are given particulars of the associations under whose auspices this book is issued, and of the County Borough Council. Section II. deals with "The Present Commercial Position," and Section III., "A Centre for New Industries," gives details of particular interest to those contemplating settling in the town. "Local Information," especially for the present and prospective private resident, occupies Section IV., while Section V. is devoted to "Halifax History in Brief." Next is the "Imperial and Foreign Trade" Section, followed by Section VII., dealing with representative Halifax firms and enterprises. Lastly, as Section VII., is a Classified Trades List of all the chief activities in the district. It is well produced and fully illustrated, and of its class is one of the best volumes we have come across.

* * *

STEAM BOILERS AND COMBUSTION. By John Batey. [Scott, Greenwood and Son, 8, Broadway, Ludgate, London, E.C. Price 4s. net (post free, 4s. 3d. home; 4s. 6d. abroad)]. This useful volume of 220 pages, with 18 diagrams, is Volume XV. in the Broadway Series of Engineering Handbooks issued by these publishers. The first chapter deals with the principles of combustion and steam production; the second includes useful and necessary information in regard to boilers and matters connected with the production of steam; while the third is concerned with water purifying or softening, standards of comparison and superheated steam; chapters IV.–VIII. deal with various types of boilers, while remaining sections are devoted to a study of combustion.

* * *

A COMPENDIUM OF AIDS TO HOME-NURSING. By N. Corbet Fletcher, M.B., M.R.C.S. Messrs. Bale, Sons and Danielsson, Ltd., of Oxford House, 83-91, Great Titchfield Street, London, W., send a copy of a useful booklet under this title, sold at 6d. net. Dr. Fletcher is author of "A Compendium of Aids to First-Aid" and "Why and Wherefore in First-Aid"; Lecturer to the Regent Street Polytechnic and to the London and North Western Railway Ambulance Centres; Examiner and Lecturer to St. John Ambulance Association and the British Red Cross Society. His latest work is of special value under present conditions.

* * *

MESSRS. JOHN BARTHOLOMEW AND CO., of The Geographical Institute, Edinburgh, have added to their high-class series of maps one of special interest at the present time, of Italy and the Balkan States. The price is 1s. net.

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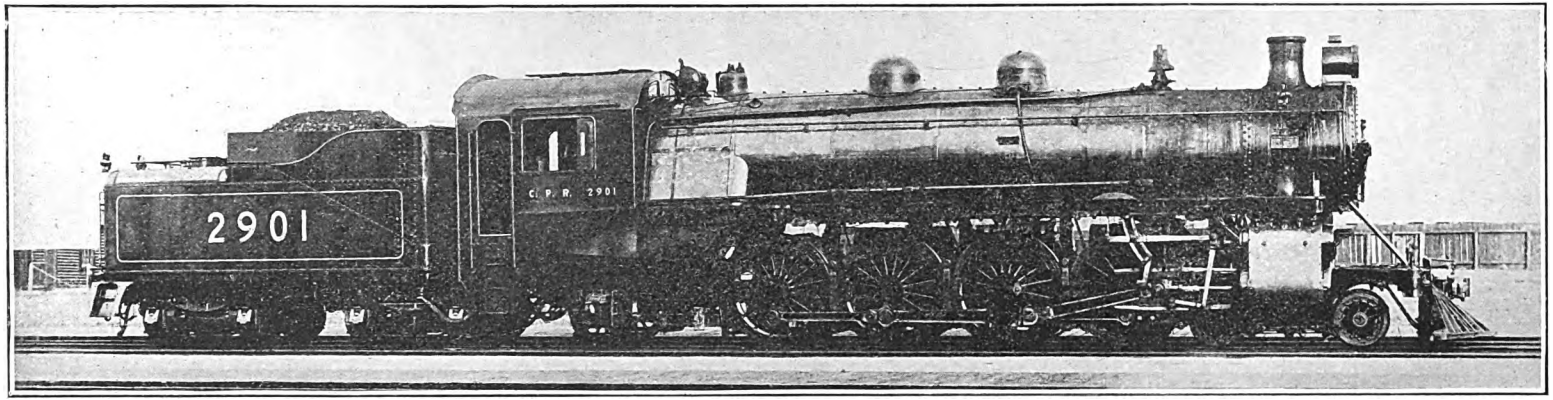
THE FIRST "MOUNTAIN" TYPE (4-8-2) LOCOMOTIVES IN CANADA.



4-8-2 LOCOMOTIVE: CANADIAN PACIFIC RAILWAY.

The 4–8–2 or "Mountain" type was first originated on the Chesapeake and Ohio Railroad in the United States and has since been adopted on several other American roads for heavy passenger traffic over mountainous divisions. The locomotive illustrated above is one of two recently built at the Canadian Pacific Railway Workshops for service on the mountain sections of that line, these being the first engines of the type in Canada. These engines, No. 2900 (class HIa) and No. 2901 (class HIb), were placed in service last August. The design, as a whole, is derived from recent 2–8–0 and 2–8–2 engines in service, many details being interchangeable. One of the main features of No. 2900 is the style of the firebox adopted, which is 13 ft. 5⅜ in. long by 7 ft. 4⅞ in. wide, fitted with a Gaines combustion chamber and arch. No. 2901 has a firebox of ordinary type, 7 ft. 4⅞ in. wide by 8 ft. 0¾ in. long inside. Both engines are equipped with the Vaughan-Horsey superheater, vestibuled cab, and screw reverse gear.

Leading dimensions of the two engines are as follows:—

	No. 2900.	No. 2901.
Boiler pressure	200 lb.	200 lb.
Number of tubes	210 & 30	43, 136, 30
Diameter of tubes	2¼ & 5¼ in.	2¼, 2½, 5¼ in.
Length between tube sheets	20 ft. 7⅜ in.	25 ft. 3⅜ in.
Average length of superheater tubes	19 ft. 4½ in.	24 ft. 0½ in.
No. and diameter of superheater tubes	126 x 1¼ in.	120 x 1¼ in.
Superheating surface	760 sq. ft.	943 sq. ft.
Firebox heating surface	265 ,,	221 ,,
Arch tube heating surface	44 ,,	30 ,,

	No. 2900.	No. 2901.
Tube heating surface	3,402 sq. ft.	3,929 sq. ft.
Fire heating surface	3,711 ,,	4,180 ,,
Total of all heating surface	4,471 ,,	5,123 ,,
Grate area	59·6 ,,	59·6 ,,
Cylinders	23½ x 32 in.	23½ x 32 in.
Coupled wheels	5 ft. 10 in.	5 ft. 10 in.
Weight of drivers	192,000 lb.	192,000 lb.
Total weight of engine	286,000 ,,	286,000 ,,
Loaded weight of tender	157,000 ,,	157,000 ,,

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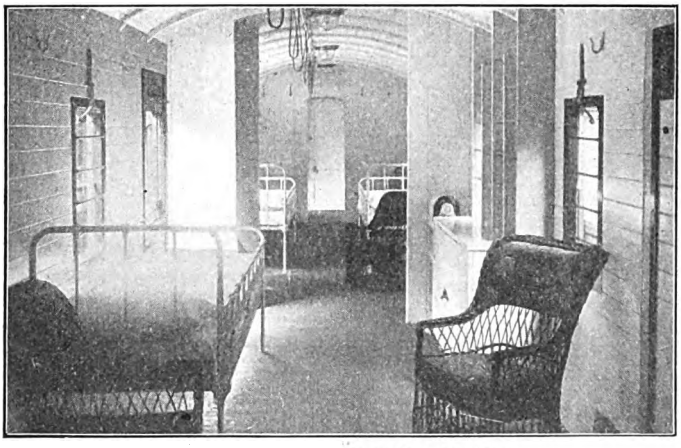


INTERIOR VIEW: READY FOR USE.

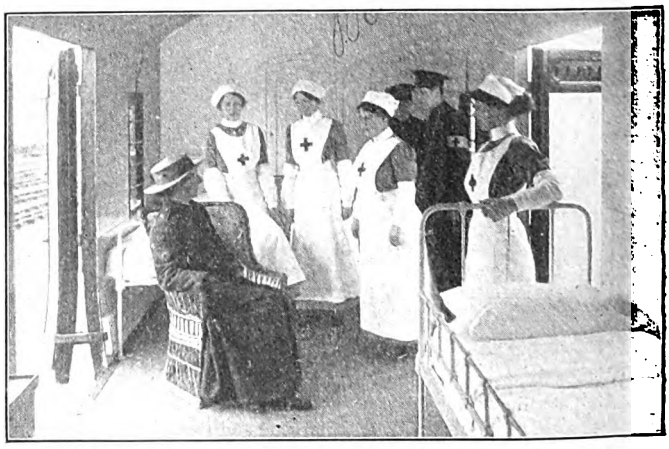
Ambulance Car: Glasgow and South Western Railway.

ILLUSTRATED on this page are interior views of an ambulance car provided by the Glasgow and South Western Railway for general use, especially in cases where "red cross" accommodation is called for, but a complete hospital train is not required.

Mounted on two bogies of the "Fox" pattern carried on laminated springs with "Timmis" patent helical springs under the bolsters, the car measures 44 ft. 3 in. long and 8 ft. 6 in. wide over the body. There are two double and two single doors on each side with an outlook projection on either side at centre providing two seats. The car is "dual" fitted and can be worked over any railway system in Great Britain, and has the standard gangway communication at either end. Ventilation is obtained from eight side windows, the top half of which is made to slide, the opening being adjusted at will, also four efficient roof ventilators with dust shields to inside of car.

The cots are 6 ft. 6 in. long and 2 ft. 6 in. wide, having well-finished and comfortable spring and hair mattresses and are firmly secured to flooring of car. A small dressing room and lavatory are fitted at one end, the dressing room being provided with wash-hand basin having hot and cold water taps, mirror, and towel rail. A large tank for supplying the lavatory, wash-hand basin and water heating apparatus with water is carried overhead at this end. The lavatory is divided off from the dressing room and forms a separate compartment.

There is also provided a wire rack for carrying any necessary utensils and linen chest or locker with shelving. The interior of the car is finished in white enamel, presenting a bright and pleasing appearance; the floor is laid with linoleum, and the lighting is by incandescent gas. Externally the character of the vehicle is denoted by a red cross on a white ground painted on each side of the car.



NURSES AND STAFF IN GLASGOW AND SOUTH WESTERN RAILWAY AMBULANCE VAN.

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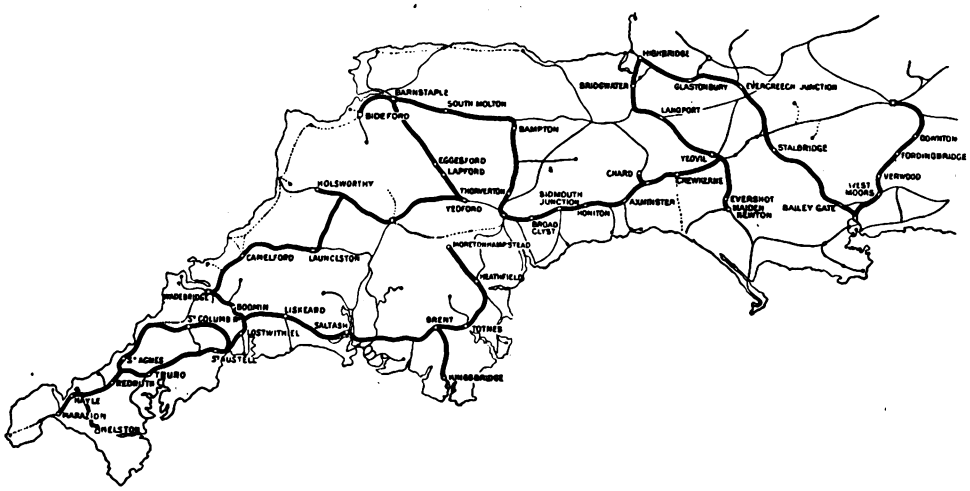
A South Western Counties Egg and Poultry Demonstration Train.

IN 1910 a then novel departure in poultry-keeping education was introduced when an egg-train, organised by the National Poultry Organisation Society, traversed South Wales. The result of that tour was so encouraging that a similar trip was arranged by the same society, in conjunction with the Agricultural Organisation Society in April of 1913, when North Wales was visited. Both these projects having more than fulfilled the purpose for which they were organised, the Agricultural Organisation Society, with the approval of the Development Commission and the Board of Agriculture, made arrangements for what is known as the South Western Counties Egg and Poultry Demonstration Train to make a three weeks' tour of the counties of Wilts, Hants, Dorset, Somerset, Devon and Cornwall. On July 6th the train started from Waterloo Station, London, for Downton, where the first demonstration was given on the following day.

The train consists of two large vans and a dining-saloon. One of the vans is divided so as to provide a dark-room for lecture purposes. Methods of packing eggs are also shown, and in addition to diagrams, six wire receptacles are provided, holding sixty (half a great hundred) 18lb. eggs. The first receptacle contains this weight, the remainder having sixty 17lb., 16lb., 15lb., 14lb., and 13lb. eggs, the gradations in total bulk being seen at a glance. There are also models of many forms of modern houses, brooders, incubators, coops, and the like, together with charts and diagrams, the whole making a very practical display, in every way calculated to help the object of the promoters of the train, which is primarily to organise the marketing of produce.

A map is reproduced showing the tour arranged for this train. Demonstrations were arranged at the following places: July 7th, Downton, Fordingbridge; July 8th, Verwood, West Moors, Bailey Gate; July 9th, Stalbridge, Evercreech Junction, Glastonbury; July 10th, Highbridge, Bridgwater, Langport; July 12th, Evershot, Maiden Newton, Yeovil (Hendford); July 13th, Crewkerne, Chard, Axminster; July 14th, Honiton, Sidmouth Junction, Broad Clyst; July 15th, Thorverton, Bampton, South Molton; July 16th, Bideford, Barnstaple; July 17th, Eggesford, Lapford, Yeoford; July 19th, Holsworthy, Launceston, Camelford; July 20th, Wadebridge, Bodmin, Lostwithiel; July 21st, St. Columb Road, St. Agnes, Redruth; July 22nd, Marazion, Hayle; July 23rd, Helston, Truro; July 24th, St. Austell, Liskeard, Saltash; July 26th, Brent, Kingsbridge, Totnes; July 27th, Totnes, Heathfield, Moretonhampstead. The tour was in every way highly successful, and the demonstrations were well attended at each place.



ROUTE OF THE SOUTH WESTERN COUNTIES EGG AND POULTRY DEMONSTRATION TRAIN, SHOWING PLACES SERVED.

Travelling on the train were Mr. Arthur D. Allen as director, assisted by Mr. W. Angus, both of the Agricultural Organisation Society; Mr. Verney Carter, egg "expert"; Miss Connell, poultry instructress to the East Suffolk

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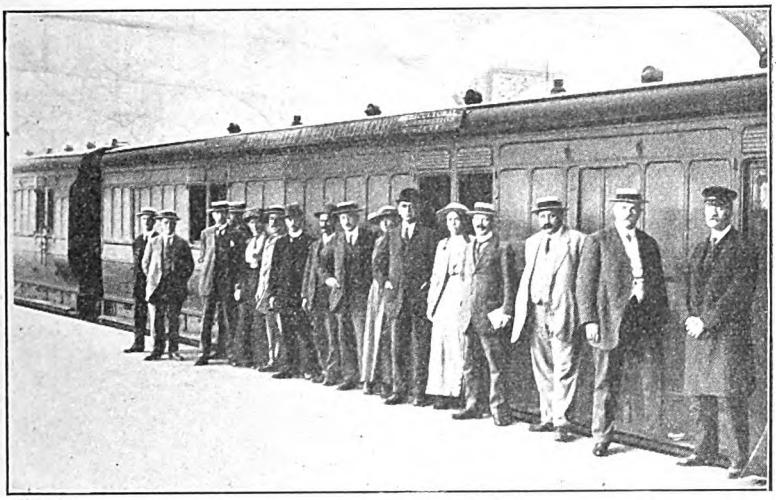

THE EGG AND POULTRY DEMONSTRATION TRAIN READY TO START FOR WATERLOO STATION, LONDON.

Among those standing alongside the train may be noted Mr. W. Buckmaster (Chief Clerk to the General Manager, London and South Western Railway), next the guard, Mr. F. V. Milton (Publicity Department, London and South Western Railway), fourth from the right, and Mr. J. Harrad, Mr. Milton's Chief Assistant, extreme left.

County Council; and Mr. Ben Taylor, an expert in poultry fattening. In addition, various county poultry instructors boarded the train and lectured in their own particular areas.

Mr. F. V. Milton, Publicity Manager, London and South Western Railway, made all traffic arrangements for the tour, and accompanied the train for part of the time. The demonstration cars consisted of two large parcel vans adapted for the purpose, while a composite dining car provided for the accommodation of the lecturers and staff, meals usually being served while travelling from place to place.

In the first car there was an exhibit of egg boxes, by the Dairy Outfit Co.; an "Astley" egg carrier; Hearson foster-mother and incubator; Hearson "crammer"; "Uckfield" scratching shed, and other poultry equipment; a "Norwich" automatic feeder and exerciser; a Spratt's chicken coop and run; a series of exhibits from Leeds University, showing the development of the chick within an egg; a home-made brooder, and several examples of brooders on the market; a "Hebbitch" incubator; marking rings for poultry and examples of poultry foods.

The second coach contained, *inter alia*, exhibits of fattening coops, with occupants including a selection of live birds, a comprehensive egg exhibition, egg-barometer, trap-nests, and displays by the Framlingham Co-Operative Society and an egg society at Granston, Pembrokeshire, the latter having been founded as a direct result of the tour of the South Wales egg-train. The end compartment of this car was fitted up as a dark room, where Mr. Verney Carter explained the mysteries of an egg, and the many varieties known to the trade.

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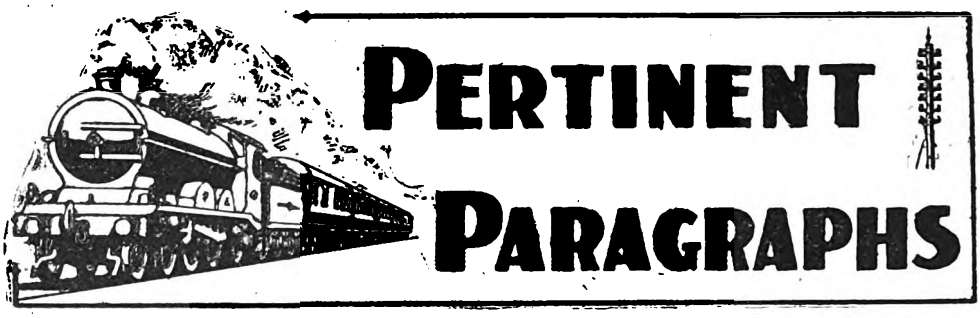

French Recognition of British Railway Services.

Mr. F. H. Dent, General Manager, South Eastern and Chatham Railway, has been made an *officier de la Legion d'Honneur*. This distinction was handed to Mr. Dent by His Excellency the French Ambassador, Mons. Cambon, who expressed on behalf of the French President the appreciation of our Allies of the valuable services rendered by Mr. Dent to France. It is an open secret that the strain of war transport has been exceptionally heavy on the South Eastern and Chatham Railway, and when the story of the war comes to be fully told the part taken by the South Eastern and Chatham Railway will prove to have been of vital international service. Mr. Dent is the second son of the late Admiral Dent (who, for a long period, was Marine Superintendent of the London and North Western Railway). At the age of seventeen he entered the service of the London and North Western Railway in the General Manager's Office. This was in October, 1884, and in 1886 he was transferred to the Superintendent of the Line's Department. Three years later he was appointed an Outdoor Assistant of the Superintendent of the Railway, and, in 1893, he became Assistant Superintendent of the Chester and Holyhead division. In May, 1899, or less than six years later, when only 32 years old, he was made Superintendent of the same district, and in October, 1901, took over the charge of the District Goods Manager's Department in addition to his other work. He was made Goods Traffic Superintendent for the London District in March, 1902, with headquarters at Broad Street station. In the spring of 1903 Mr. Dent visited the United States of America with a party of London and North Western Railway officers. In April, 1907, he left the service of the London and North Western Railway to take the position of Chief Goods Manager of the South Eastern and Chatham Railway. This appointment he held until the retirement of the late Mr. Vincent W. Hill, Mr. Dent being then made General Manager, taking up his new duties on April 1st, 1911. Mr. Dent was Chairman of the Railway Clearing House Goods Managers' Conference, 1909. He is a member of the Advisory Committee on railway subjects at the London School of Economics, and is on the Court of Governors of that Institution. Likewise he is a member of the Railway Executive Committee.

New Railway Methods under War Conditions.

Twelve months of war that have now elapsed have produced many changes in the railway world, especially in methods of dealing with traffic; and our Great Western Railway contemporary points out several examples of further development introduced with a view to economising staff in order to liberate men for national service. Inquiries have shown that in many places, by the amalgamation of cartage establishments, the closing of town receiving offices, the withdrawal of staff from stations of other companies used under running powers or working agreements, and in other directions, it is possible to release further staff. Effect has been given to many such proposals. For example, the Great Western Company's representation at Alcester on the Midland Railway, and at Wadebridge on the London and South Western Railway, has terminated, the parent companies in each case having undertaken to do the business of both companies. At many of the town receiving offices where, in the public interest, it is not possible to close the establishments entirely, female labour is being utilised, thus enabling male staff to be released.

Arrangements have been made, commencing on July 1st, for the stamp and label system, which has hitherto applied only to "local" parcels traffic, to be extended to the parcels traffic passing between any of the Government controlled railways. Under this system waybilling of parcels traffic is abolished, being substituted in the case of prepaid parcels traffic by stamps which indicate the amount paid for carriage, and in the case of "to-pay" traffic by labels showing the amounts to be collected at destination. Much time and labour in handling parcels at the receiving end are saved by the adoption of this system, as each parcel is self-checking—that is to say, it is not necessary for a check to be made with any documents other than the stamps or labels which are pasted on the parcels. Under the waybill system the parcels have to be checked with the waybills, involving other subsidiary checks and entries. The stamp and label system, as applied to traffic in which two or more railways are interested, is essentially a "pooling" arrangement, and the conditions at present governing railway operation facilitate the working of such a system. When the former conditions of control are reverted to, it will be necessary, as

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our Great Western contemporary reminds us, to make some revision, but it is more than likely that the stamp and label system will be continued if a scheme for allocating receipts can be evolved.

French Railways and War Transport.

It is only by degrees, and then largely from neutral sources, that information is coming to hand as to the details of operations at or associated with the field of war. Our American contemporary, *The Railway Age Gazette*, under the authorship of Mr. Walter S. Hiatt, their special European correspondent, gives particulars of what the French railways did at the time of the Battle of the Marne. On mobilisation 10,000 trains were kept going during the twenty days of the first period. Having just finished concentrating the seven French armies, between August 12th and 20th, 1914, the Northern, Eastern, and Western (State) Railways hauled the little English Army from Boulogne, Nantes, and St. Nazaire to Mons, handling 420 trains, many of them at close intervals, and that without disturbing the general concentration work of the French Army. For a long time afterwards 42 trains were regularly employed in carrying stores, food, and ammunition to the armies in the field. The Paris, Lyons and Mediterranean Railway also brought 60,000 troops across France from Africa. During the famous Retreat from Mons, trains were kept waiting to save as many of the troops as possible, and while the Allied forces were so bravely contesting every foot of ground, from 120-170 trains were utilised for Army purposes almost daily. At this time, too, the railways were busy dealing with the civil population fleeing out of Belgium and the invaded French provinces, many thousands of people being transported to Calais, Havre, or Paris. No less than 2,700 Belgian locomotives were also brought to France. The biggest thing of all, however, according to Mr. Hiatt, was the transport of an army from along the Meuse, north of Verdun, to within 18 miles of Paris. 180 trains were utilised, and this army of about 100,000 men later played the chief rôle in the Battle of the Marne.

The Transfer of the French Government to Bordeaux.

In reference to the transfer of the Government temporarily to Bordeaux, Mr. Hiatt describes how before midnight on September 2nd three special trains were sent off, one carrying the President and his Staff, the other conveying Ministers and their staffs, whilst following trains brought $800,000,000 gold deposits of the Bank of France, State papers and documents, with further trains for the transit of precious paintings, statuary, and other treasures of the Louvre, the Luxembourg Gallery, and other places. Then, while the railways were desperately hurrying men and munitions forward in one direction, they were also carrying refugees from Paris by the hundred thousand. All sorts of cars took away 50,000 or more people daily. And yet all this was done when, in many cases, the railways—particularly the Northern and Eastern lines—were in difficulties owing to portions of their lines being in the possession of the enemy or within the fighting area. During five weeks one railway carried no less than 1,600 provision trains, in many cases over lines strange to the men. And when 52 ships arrived at Marseilles with 70,000 Indian troops and their baggage, these troops were conveyed in three days to their camping ground at Cercottes, near Orleans. These are only a few facts collected by Mr. Hiatt, and he gives many other details, presumably based upon official data obtained in France, but they serve to indicate in some degree what the railwaymen of France did at that critical period, and the bestowal of the Cross of the Legion of Honour on dozens of stationmasters, enginemen, firemen, conductors, and others, is an indication that France was not slow to appreciate what had been done by the "cheminots," the railway officers and employés.

What the Great Western Railway has done.

In view of Britain's urgent and immediate need of munitions of war, the railway companies in this country have not been slow to organise the manufacture of war materials in their workshops, and an astonishing output has resulted from the efforts of an industry that was only expected to deal with the transportation, and not with the production, of war manufactures.

Some particulars of what has been done in this way by the Great Western Railway have been published in that company's periodical. One of the early acts of the Government when war was declared was to request the railway companies to undertake the construction of ambulance stretchers. With such celerity were something like 12,000 completed that demands for other manufactures were made upon the workshops, and there were turned out some thousands of general military service road wagons, over 100,000 artillery wheel spokes, something like 200,000 picketing pegs and posts, and, more important still, several hundred gun carriages. Coming more within their usual manufacturing capacity has been the provision of armoured trains and the construction of several ambulance trains, the latter being not only for use in this country but some for service on the Continent.

Railway companies were also requested to undertake, and have done so successfully, the manufacture of armaments and ammunition. Such work necessarily involves very intricate manufacture which could not be performed on ordinary lathes and machines, and could only be undertaken in large and well-equipped shops. At Swindon the Great Western Railway works have been equal to the requirements of the moment. The utilisation of all the resources there is in full swing, and by working holiday

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time and overtime the indispensable items of equipment for war are being rapidly manufactured. Generally it must be admitted that amongst the many services necessary for the successful conduct of the war, the part taken by the railways of the country in the ready adaptation of their workshops to the production of the munitions of war, must rank as of high importance.

"Munition" Meetings in Railway Workshops.

RECENTLY, Mr. Ernest Craig, M.P., addressed a series of meetings in Crewe Works on behalf of Mr. Lloyd George, Minister for Munitions.

On Tuesday, July 27th, Mr. W. W. H. Warneford, Works Manager, introduced Mr. Craig to a meeting held in the Fitting Shop, Old Works, and applying to workmen from the Tin Shop, Nos. 1, 2, 3 and 4 Repairing Shops, Smithy, Spring Shop, Loco. Stores, Grease Works and Fitting Shop. Approximately, 1,490 men attended. On Wednesday, Mr. Warneford again introduced Mr. Craig, the meeting being held in the Boiler Shop Arcade, and including men from Nos. 5, 6, 7, 8 and 9 Erecting Shops, Iron Foundry, Tender Shop, Brick Yard, Pattern Shop, Plate Stores, Boiler Shop and Smithy, Points and Crossing Shop, and Fitting Shop. Approximately, 2,400 men attended. On Thursday, Mr. C. J. Bowen Cooke, Chief Mechanical Engineer, introduced Mr. Craig in the Signal Shop to workmen from the Joiners', Millwrights' and Paint Shops, Stone Yard, Chain and Testing, Signal, Electric and Bolt Shops, Brass Foundry and Wheel Shop, the approximate number of men present being 1,300. A further meeting was held in the Rail Mill on Friday, for workmen from the Forge, Rail Mill, Steel Foundry, Melting Furnaces, Copper Shop, Yard men and Gas Works, where about 1,200 men attended.

Before introducing Mr. Craig on Tuesday and Wednesday, Mr. Warneford briefly advised the assembly that they were about to listen to a message from the Minister of Munitions, and, at the same time, he took the opportunity of telling the workmen how much the high-class work they had lately done was appreciated by the various Government workshops to which it had been sent, and that it was a surprise that they had been able to undertake work entirely different from what they had been in the habit of performing in so short a time, and that he had it on the highest authority that there was a clean sheet as regards complaints either of quality or quantity. He impressed upon the men the importance of continuing to work with the same accuracy in any class of work they might be called upon to undertake, so that they will be able to maintain the high reputation that the working men of Crewe had always carried.

Crewe's Good Record.

MR. BOWEN COOKE, speaking at the meeting on Thursday, July 29th, said: "First of all, I wish you to understand that this is not a campaign of criticism; indeed, very much the reverse. I am only too proud to think what Crewe men have done in munitions of war since we first took up the question. Crewe men have really come to the front splendidly; they have given two of the best things in their possession, and have given willingly, not only in connection with munitions of war, but in connection with other grave matters which have occurred during the present national crisis. They have given the best of their skill and commonsense in the cause of patriotism. I formed one of a deputation to interview Mr. Lloyd George, a deputation which consisted of members of the Railway War Manufacturers Sub-committee, and what Mr. Lloyd George told us personally we felt to be of such grave importance that we thought it would be the right thing if a gentleman like our friend, Mr. Craig, would come as a direct emissary from Mr. Lloyd George to give you the same information personally that he gave to us."

In the course of his address Mr. Craig stated as follows: "Mr. Lloyd George first wishes me to thank the men of Crewe for the efforts they have put forward in the past, and I do so with the greatest pleasure and satisfaction, for never inside the House of Commons or outside the House have I heard a word of reproach against the men of Crewe. Their patriotism has never been impeached. Mr. Lloyd George asks you, in order that we can meet this grave situation which is upon us, to do all you can to increase the supply of munitions." Later, he spoke in reference to men engaged in railway repair work. "Their work is as important at the present time as that of men who are actually engaged on munitions. Mr. Cooke assures me that if the men will do their utmost on this class of work he will probably be able to withdraw more men for munition work."

At the meeting in the Rail Mill Mr. C. J. Bowen Cooke stated that it is absolutely necessary that the great railways which have to deal with the transport of soldiers and munitions, that keep together the life of the country, must be kept up. "You must realise that owing to the number of men that have gone to the front, and the number engaged on munition work we have undertaken, it must affect the repairs to engines and tenders, and it is of vital importance to the country that we do not get behindhand in this respect. I beg of you all to help in this very great matter of keeping the railways of the country going. It is those who produce the material for the making and repairing of locomotives who have this all important matter in their hands."

Honours for Railwaymen on Active Service.

THE following London and North Western Railwaymen have been granted the Distinguished Conduct Medal or have been mentioned in despatches, etc. *Awarded the Distinguished Conduct Medal*:—H. J. Vickers, Driver, No. T/27,823, 7th Company, Army Service Corps,

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formerly under shunter in the Traffic Department at Willesden; F. Marshall, Private, No. 4,570, Royal Army Medical Corps, formerly a labourer in the Permanent Way Department at Stockport; J. E. Healey, Private, No. 8,443, 1st East Surrey Regiment, formerly a porter in the Goods Department at Broad Street; H. D. Peabody, Sergeant, No. 1,764, 9th County of London Battalion, The London Regiment (Queen Victoria's Rifles, T.F.), formerly a clerk in the Chief Accountant's Office at Euston; J. Fearnchough, Company Quartermaster Sergeant, No. 6,432, 2nd South Lancashire Regiment, formerly a labourer in an extra gang, in the Engineering Department at Edge Hill; W. W. Howarth, Private, No. 3,298, 10th Scottish Battalion, Liverpool Regiment (T.F.), formerly a checker in the Goods Department at Waterloo Station, Liverpool; E. Smith, Corporal, No. 2,039, 1st King's Own Yorkshire Light Infantry, formerly a carter in the Goods Department at Sheffield; E. Salisbury, Private, No. 7,967 or 7,980, 2nd Royal Welsh Fusiliers, formerly an extra porter in the Goods Department at Birkenhead; E. Owens, Company Sergeant-Major, No. 7,788, 1st Cheshire Regiment, formerly a loader in the Goods Department at Birkenhead. *Mentioned in Sir John French's Despatches*:—G. E. Holland, Temporary Lieutenant-Colonel, C.I.E., D.S.O., Royal Engineers, formerly Marine Superintendent at Holyhead; W. F. Kilminster, Private, No. 8,302, Duke of Cornwall's Light Infantry, formerly a stableman in the Goods Department at Camden; P. Goode, Private, No. 4,870, 1st Battalion, Royal Welsh Fusiliers, formerly a labourer in the Wagon Department at Chester; P. J. Fulks, Sergeant, No. 6,697, 1st Battalion, Wiltshire Regiment, formerly a signalman at Harlesden; H. Green, Private, No. 8,294, 1st West Yorkshire Regiment, formerly a cleaner in the Locomotive Steam Shed at Farnley Junction. *Specially Commended by Commanding Officer*:—T. Dixon, Private, No. 8,652, 1st East Lancashire Regiment, formerly a fire-carrier in the Locomotive Steam Shed at Preston; J. Simpson, Sapper, No. 54,925, 110th Company, Royal Engineers, formerly a labourer in the Permanent Way Department at Crewe.

LONDON, BRIGHTON AND SOUTH COAST RAILWAY COLLECTING DOG "HECTOR" AT BRIGHTON.

Railway Warriors.

EVIDENCE frequently reaches the RAILWAY MAGAZINE office that the railwayman who "to the war has gone" does not leave behind him his interest in the iron-road and the locomotive. A sample instance is a letter received on August 6th from a private engaged with the British Mediterranean Expeditionary Force. He wrote: "Having worked on the Great Western Railway, I should be very pleased if you would send me a RAILWAY MAGAZINE, as one of my old favourites would be a treat to read, when we are having a rest." Needless to say a spare copy was posted to our old reader, but as the publishers are already supplying month by month many free copies for the use of the troops—and publishers, like fishmongers, cannot live by giving stock away—it is felt that readers engaged in civil occupations may like to assist in satisfying the demand of our fighting men for railway literature by making use of the facilities afforded by the Post Office for the free conveyance of magazines, not more than twelve months old, handed in for the benefit of British soldiers and

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sailors. Full particulars were given in the August RAILWAY MAGAZINE, page 156. It is earnestly hoped that full advantage will be taken of the arrangements made by His Majesty's Postmaster General, so that our gallant soldiers and brave seamen formerly employed in the railway service or interested in railway and locomotive working may not go short of the literature they so thoroughly appreciate.

Railways and the War Loan.

IN the August RAILWAY MAGAZINE particulars were given of the arrangements made on several railways in order to enable their staffs to subscribe conveniently to the War Loan. Reference may now be made to further arrangements of the same character, of which particulars were not available at the date we closed for press last month.

Midland Railway. The Directors decided to purchase immediately sufficient stock to meet the estimated requirements. At the request of the staff, deductions will be made from their salaries or wages of not less than 1s. per week, which will enable the payments for £5 of stock to be extended over a period of about two years. The company will pay interest at the rate of 5 per cent. per annum on the amounts so contributed until the deductions amount to £5, when stock to that amount will be transferred to them without charge. As a further facility the company will, at the request of any depositor in the Midland Railway Savings Bank, apply any sum of money standing to his credit to the purchase of stock at the rate of £4 19s. 4d. for each £5 of stock up to £200. The company have subscribed for such an amount of the new War Loan as will bring their subscriptions to the old and new Loans combined up to one million and a quarter.

Furness Railway. In order to assist the employés desirous of acquiring 4½ per cent. War Loan Stock, the Directors authorised arrangements by which payments for the stock could be made, at the request of the subscribers, by deductions through the monthly or weekly pay bills. These deductions are made at the rate of 2s. per week in respect of each amount of £5 of Stock, but not exceeding a sum of £50. A bonus of 1s. is allowed on account of each £5 of Stock and Interest at the rate of 5 per cent. per annum for completed months on the weekly deductions. The deductions commenced in the pay bills for the period ending August 14th, and provide for completion on June 25th, 1916. The Stock subscribed for will then be placed in the name of the subscriber, who will be entitled to the interest accruing from June 1st, 1916. If cases should arise in which, owing to unforeseen circumstances, a subscriber becomes unable to complete his payments, arrangements will be made for the return of his subscriptions with interest at 5 per cent. per annum up to the date of the last deduction.

Great Northern Railway (Ireland). With a view to facilitating investment in the War Loan by its employés the Company arranged to purchase £5,000 of the Stock for allotment to the staff, and to accept payment by deduction from salaries or wages at a rate of not less than 2s. 6d. per week for every £5 of stock applied for until the forty instalments have been completed. Interest at 4½ per cent. per annum is allowed on the instalments paid from the date of payment until June 1st, 1916, when they will hand over the scrip to the purchaser.

Maryport and Carlisle Railway. A notice was issued by Mr. Thomas Blain, Secretary, in the following terms: "If the Directors agree to buy £5 Certificates of the New War Stock from the Post Office, on behalf of the Company's employés, I should like to know whether any, and what number, of our men would wish to take up £5 or any multiple thereof. The method would be that the £5 Certificates would be held by Mr. Hartley, Chairman, Mr. Harris, Deputy-Chairman, and myself, Secretary, as trustees, until the men on whose behalf they are purchased pay off their value by weekly instalments from their pay at a rate of not less than 2s. nor more than 4s. 6d. per week for every £5 of stock. The trustees will credit the subscribers with the interest accruing on each £5 Stock until it is paid up, as well as with any discount allowed, and there will be no deduction for interest on the amount which the Company will advance for the immediate purchase of the stock. Should any employé find himself unable through unforeseen circumstances to continue his weekly instalments he will be entitled to be refunded the amounts deducted from his pay, but without interest."

Great Southern and Western Railway. The following circular was issued by the General Manager, Mr. E. A. Neale: "The Directors of the Company desire to assist their employés to invest in the War Loan, and for this purpose they propose to purchase War Loan Stock immediately, and allow their employés to redeem it from them by contributions to be deducted from their salary voucher or pay sheet according to the following scale: 1s. per week—100 weeks—for purchase of £5 bond; 2s. per week—100 weeks—for purchase of £10 bond; 3s. per week—100 weeks—for purchase of £15 bond; 4s. per week—100 weeks—for purchase of £20 bond. Corresponding periodical deductions will be made in the case of applicants whose salary or wages are paid fortnightly or monthly. The Company, after purchasing the bonds, will hold same until the payments through the pay lists are completed, when the bonds will be handed over together with interest at 4½ per cent. per annum on the contributions."

Metropolitan Railway. Mr. R. H. Selbie, General Manager, notifies his staff "that the Metropolitan Railway Company is desirous of affording facilities to the members of the staff to subscribe to the new War Loan, and arrangements have accordingly been made under which subscriptions can be dealt with through the weekly paybills. Any member of the staff subscribing 5s. per week for twenty weeks commencing week ending July 17th, will be

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entitled on December 15th next to a £5 stock certificate, bearing interest at the rate of 4½ per cent. Smaller weekly amounts, viz., 1s. 2s., 3s., or 4s. can be subscribed by deductions through the pay sheets, and scrip vouchers will be purchased monthly by the Company and handed to each subscriber when the total sum deducted amounts to 5s. 10s., or £1. It should be borne in mind, however, that in order to secure interest, vouchers to the aggregate value of £5, or multiples thereof, should be obtained by not later than December 1st."

North Staffordshire Railway. Any member of the staff desirous of investing money in the War Loan was requested to communicate with Mr. R. E. Pearce, the secretary, on or before Wednesday, July 21st, stating: (1) The amount of loan he wished to take up; (2) the sum per week, not to be less than 2s. or more than 4s. 6d. in respect of every £5 he wishes to invest, which he is prepared to have deducted from his wages. Men who are prepared to pay 5s. or more per week were recommended to apply at the Post Office.

Taff Vale Railway. This Company made arrangements whereby scrip vouchers may be purchased at the time the wages and salaries are paid, or at any other time which may be convenient, at any of the Company's stations.

Underground Electric Railways of London. The Underground Electric Railways of London and the allied companies applied for a further £400,000 in the War Loan, this, with their previous subscription and conversion rights, entitling them to £800,000. The T.O.T. Companies have made arrangements which will enable their employés to secure £5 stock by instalment payments of 2s. weekly and upwards.

Institution of Locomotive Engineers.

A SPECIAL general meeting of this Institution, held at Caxton Hall, Westminster, on Saturday, July 24th, formally confirmed the memorandum and articles of association, bye-laws and rules incidental to "incorporation," as settled with the Board of Trade. It is somewhat remarkable that the "centenary of the locomotive engine" should have passed before the constitution in the United Kingdom of an association concerned directly with technical and practical aspects of locomotive engineering. The explanation is that the locomotive engineer usually requires in practice to go much beyond the confines of his principal subject, and therefore the senior institutions, such as the Civil and Mechanical Engineers, have always given locomotive subjects considerable attention, and locomotive engineers have always ranked prominently among their members. It has been felt, however, for some time past that there was a real need for an institution dealing primarily with locomotive subjects—steam, electric and internal combustion—and in February, 1911, a modest beginning was made as the Junior Institution of Locomotive Engineers. Initial stages were largely due to gentlemen in the locomotive department of the London, Brighton and South Coast Railway, the inaugural meeting being called by Mr. G. F. Burtt (who was at first Hon. Treasurer), while the first Chairman was Mr. F. B. Carmichael, and the first Hon. Secretary Mr. T. H. Baxter, all associated therewith. The first President was, however, Mr. J. H. Adams, Locomotive Superintendent, North Staffordshire Railway, and the membership soon extended considerably beyond the London, Brighton and South Coast Railway. In September, 1911, Mr. Baxter resigned as secretary, owing to his taking up a position in Uganda, and in the same month Mr. Carmichael left for China. Mr. C A. Suffield, London manager, United States Metallic Packing Co., Ltd., was appointed Chairman, and Mr. G. F. Burtt took over the dual position of Hon. Secretary and Treasurer, and it is mainly owing to the enthusiasm and energy of these two gentlemen that the Institution has become what it is. At the end of 1911, the first year of its existence, the membership was 89; twelve months later, under the presidency of the late Professor Elliott, it had increased to 117; in December, 1913, Mr. Henry Fowler, Chief Mechanical Engineer, Midland Railway, being President, there were 159 members; and at the close of 1914 there were 179 members. For 1914 Mr. A. J. Hill, Chief Mechanical Engineer, Great Eastern Railway, was President, and he holds that position again for 1915.

Position and Prospects of the Institution.

IN the unavoidable absence of the President, Mr. A. J. Hill, and of Mr. Henry Fowler, Past President, the chair was occupied by Mr. A. R. Bennett, M.I.E.E., Vice-President. In opening the proceedings, the Chairman outlined briefly the objects and effects of incorporation, and Mr. G. F. Burtt reviewed the principal features of the new constitution. Seeing that numerous meetings had been held, and many hours had been spent by the Incorporation Committee, while various suggestions by members had already received attention, the memorandum and articles of association and bye-laws were unanimously adopted without further discussion, and in doing so the members indicated their appreciation of the work done by the Incorporation Committee, consisting of Messrs. C. A. Suffield (Chairman), W. A. Lelean (Vice-Chairman), A. Woolford (Deputy Vice-Chairman) and J. F. Gairns (Member of Council), with, of course, Mr. G. F. Burtt (Hon. Secretary and Treasurer). Mr. Bennett (Chairman) expressed the opinion of the meeting that, as newly constituted, the Institution of Locomotive Engineers (Incorporated) would soon progress even more than it had done during the few years of its existence, and that in due course it would take its place among the recognised responsible institutions. Mr. C. A. Suffield then gave what was, in effect, a valedictory address, seeing that the position of Chairman, with those of Vice-Chairman and Deputy-Vice-Chairman, disappear with the new organisation. He spoke very highly of the services rendered by their Presidents, Mr. J. H. Adams, the late Professor Elliott, and Messrs. Henry Fowler and A. J. Hill.

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Speaking on behalf of the Council, Mr. J. F. Gairns expressed their appreciation and recognition of the valuable services rendered by Mr. Suffield as Chairman, and of the time, trouble and enthusiasm he has given ever since he became an officer of the Institution, associating with his remarks acknowledgment of the valuable co-operation of Mr. Lelean—who had borne the brunt of the work involved by incorporation proceedings—and Mr. A. Woolford, as also of Mr. G. F. Burtt.

August Bank Holiday Travel, with no Cheap Trains.

TRAFFIC on nearly all lines was very heavy, and in view of the conditions, with no week-end or excursion tickets available, was far greater than one would ever have expected. The south and south-west coast resorts were invaded by ordinary-fare travellers in enormous numbers, and on all lines relief and duplicating trains had to be run, while numerous trains were made up to maximum loads, and even then conveyed many passengers standing up in compartments and corridors. There were not, it is true, the usual extreme characterisites of a normal August Bank Holiday period; but on a more limited scale the traffic was really remarkable. A notable feature was the wider varieties of destination, trains for intermediate country stations being almost as numerous as those for favourite resorts. Southend and Brighton maintained a great deal of their usual favour, both on Saturday and on Monday, while Eastbourne, Bognor, Littlehampton, Worthing, Bournemouth, Margate and Ramsgate accounted for many thousands of passengers. In regard to long-distance journeys, Devon and Cornwall and North Wales were by no means behindhand, and on Friday and Saturday the bookings at King's Cross, St. Pancras and Euston for the North of England and Scotland were so heavy that many trains had to be run in two or more parts. On the Monday the popular journey was the short one. "Metro"-land, from Baker Street, also from Marylebone; Buckinghamshire beauty spots served by the Great Western Railway; Thames-side resorts; Watford, Bricket Wood, Boxmoor, Tring and Leighton Buzzard; Enfield, Cuffley, Hadley Wood and Potter's Bar; Southend, from St. Pancras, Fenchurch Street and Liverpool Street; and Epping Forest were in special favour. In other districts similar characteristics were noticeable. Notwithstanding the absence of cheap trips, plenty of intending travellers were to be found at all the Manchester stations. Blackpool was a popular choice, even with people who would hardly deign to look at the place before, and quite good business was done at Victoria Station for this favourite resort. The Royal Lancashire Show at Blackburn attracted many visitors. On the whole the traffic to holiday resorts was stated to be brisk, but well below the normal for the period of the year.

Accelerated Electric Services on the Metropolitan Railway.

ADVANTAGE has been taken of the completion of the Finchley Road–Wembley Park widenings, Metropolitan Railway, to accelerate some of the fast Baker Street–Harrow trains to cover the 9 miles 34 chains in 16, 15 and even 14 min., as compared with the old standard of 17 min. There are now several trains in 17 min. including one intermediate stop, one in 16 min., and one in the exceptional time of 14 min., besides various other detail accelerations. Thus the 8.33 a.m. from Baker Street is booked in 16 min. to Harrow with a call at Willesden Green; the 9.43 a.m. is scheduled in 17 min. with the same stop; and the 2.15 p.m. (ex. Saturdays) is a 16 min. non-stop. The 4.42 p.m. (not Saturdays) is booked in 17 min. with one stop; and the 6.17 p.m. is another 16 min. non-stop. The 6.43 p.m. calls at Wembley Park in 12 min., and reaches Harrow in 17 min. In the up direction, the following trains from Harrow may be noted: 8.27 a.m. (16 min., non-stop), 8.31 a.m., (17 min. one stop), 8.43 a.m. (16 min., one stop), 8.56 a.m. (15 min., non-stop), 9.21 a.m. (15 min., non-stop); and the 12.25 p.m. (not Saturdays) calls at Willesden Green, and yet is allowed only 14 min. On Saturdays it is allowed 3 min. longer from Willesden Green to Baker Street. On Sundays the 9.18 p.m. down train is a 16 min. non-stop.

New Railways in the Lothian District, for Coal Traffic, North British Railway.

IN August, 1913, after a stiff Parliamentary fight, the North British Railway secured the passing of a Bill the object of which was to enable the provision, by means of additional railways, fuller facilities for the transit of coal from collieries in the Lothians to Leith Dock. The Company pledged themselves to have these lines completed in two years.

In reference thereto the *Scotsman* points out that, pushed on with vigour from the start, the work would but for the war have been completed, in compliance with the undertaking given, in the early part of August. Even under war conditions it is now nearing a finish, and it is expected that the new railways can be opened in September. Owing to the war there is probably less need for them at present than there otherwise would have been. A partial arrest has been laid on the development of the coal industry in the Lothians in consequence of the great number of miners who have enlisted, and the restriction on the export of coal. However, the new railways will enable the present traffic to be handled with dispatch, and will be ready when, in happier times, additional work is laid upon them.

New Connections afforded by these Lines.

The new railways lie between Portobello and South Leith on the one hand, and between Portobello and Monktonhall Junction on the main East Coast line on the other. These new

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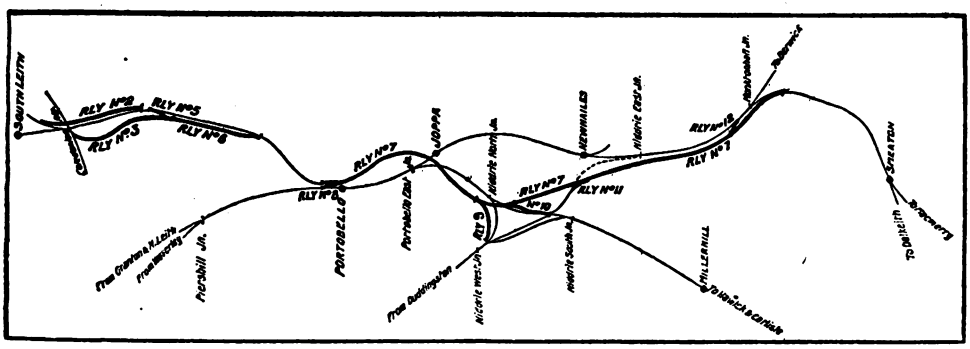
lines are numbered from 2 to 12 on the map reproduced. They are altogether not of great extent, their total length being something like 6½ miles of single lines, but their usefulness is not to be judged by their short mileage. No. 2 is a line over half a mile in length, connecting the South Leith yard with the South Leith branch railway. To enable this line to be made, a reconstructed pitched slope to the sea was necessary. It runs parallel with Seafield Road on its north side. Railway No. 3 is a line 5 furlongs 4 chains in length, connecting the Caledonian South Leith system with the North British South Leith branch, and is in direct communication with the Craigentinny new goods yard. On this line, which is on the south side of Seafield Road, there are some six bridges. By arrangement with the Caledonian Railway the North British Railway are to get the use of the engine sheds and other contingent accommodation of that Company at South Leith. At the Loaning Road level crossing, midway between the Seafield Esplanade and King's Road, Portobello, there has been a considerable diversion and widening of the public road. The portion dealt with extends to about half a mile in extent; and some 10 ft. has been added to its width—the roadway at this part having now a total width of 50 ft. One result of the diversion is that the old level crossing has been done away with. Railways Nos. 4, 5, and 6 are railways joining up with Nos. 2 and 3, and are in connection with the new yard at Craigentinny. This is a very important addition to the North British system at this point. The new Craigentinny yard is situated immediately to the east of the road diversion; and it has sufficient lines to accommodate 1,100 wagons. It is so laid out that it has a direct access both from the South Leith and Portobello ends; and sufficient land has been acquired by the Company from the Craigentinny estate for the purposes of further extension if found necessary. Railway No. 7 is the longest of the new lines, being 3½ miles in extent. It gives a new connection between Portobello and Monktonhall Junction—which is the junction on the main line for the Macmerry and Gifford coalfields. No. 8 is a short connecting line at Portobello station, between the main line there and railway No. 7; No. 9 is a line connecting No. 7 line with the Suburban Railway from Niddrie North Junction to Niddrie West Junction; No. 10 connects Railway No. 7 at Niddrie North Junction with the main line to Hawick (Waverley route) at Niddrie South Junction; No. 11 is a short connecting line between Niddrie East and West Junctions, and No. 12 railway gives a connection at Monktonhall Junction, between the new line No. 7 and the East Coast main line to Berwick.

Engineering Features.

No great engineering difficulties had to be surmounted in the formation of these new lines. On No. 7 a considerable amount of earthwork has had to be carried out, and over the Esk a lattice girder bridge has been thrown with a span of 123 ft. The other bridges on the various lines are of the usual type of steel deck bridge. An up-to-date system of signalling has been adopted on all of these railways, so that the traffic can be worked on them with the greatest safety and dispatch. On the single lines, what is called the non-token system has been adopted.



MAP SHOWING NEW RAILWAYS IN THE LOTHIAN DISTRICT, NORTH BRITISH RAILWAY.

The signals in this system are all controlled by means of electric treadles, placed at suitable positions on the permanent way, which are operated by the wheels passing over them. The arrangement is such that the signals cannot be lowered until the train in quitting the section gives the necessary relief by passing over the relief treadle applicable to the section. As the name implies, the driver of the train does not require a tablet or token, and in that way time is saved, as the fireman does not require to go to the cabin for a tablet.

Total cost of the new lines has been £220,000. This does not include the expense of the doubling, in connection with the same object, of existing lines between Portobello and South Leith, and between Smeaton and Monktonhall. For that doubling Parliamentary sanction was not required, as no new ground had to be acquired. The new lines were designed and constructed under the supervision of Blyth & Blyth, Edinburgh, consulting engineers to the North British Railway Company, and the contractors were Hugh Symington & Sons, Glasgow. All

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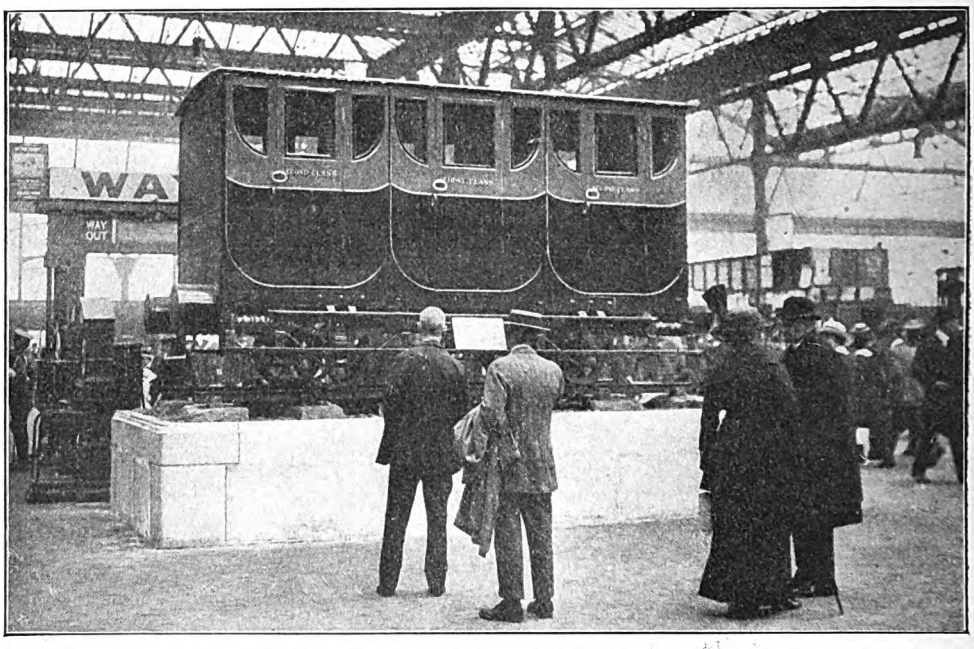
the doubling works and the signalling works of the new lines were carried out under the supervision of Mr. W. A. Fraser, Engineer-in-Chief of the North British Railway, and Mr. W. Wood, Electrical Superintendent.

Early Rolling Stock exhibited at Waterloo Station, London.

One of the vehicles used on the Bodmin and Wadebridge Railway, which has formed part of the London and South Western system since 1834, has been removed from Eastleigh, and placed in a commanding position at Waterloo station. It stands on a section of the original permanent way. The fittings of the old carriages were primitive. The third-class carriages had band-brakes to one wheel on each side. The first-class carriage only was intended to have quarter lights, but two-thirds of it appeared to have been written down to second class. Loose chain couplings were used. Inside the carriage was trimmed something like an old London "growler." The chief dimensions and weight of the vehicles were :—

	Length.		Width.		Height above rails.		Wheel-base.		Weight.		
	ft.	in.	ft.	in.	ft.	in.	ft.	in.	T.	C.	Q.
Composite	14	0	6	6½	8	5	7	6	3	5	0
Second class	10	0	6	5	8	5	6	4	2	5	2
Third class	14	10	6	5½	5	10½	6	9	2	18	1
Third brake	10	0	6	4½	5	5	4	6	1	19	0



OLD BODMIN AND WADEBRIDGE PASSENGER CARRIAGE NOW EXHIBITED ON A PEDESTAL AT WATERLOO STATION, LONDON AND SOUTH WESTERN RAILWAY.

New Coal Tips at Barry Docks.

The first of the new Coal Tips which have been under construction for some time at Barry Docks was opened for traffic in the week ending August 7th, 1915, and the s.s. *Sheaffield* has been loaded there by Messrs. Cory Bros. & Co. Of the latest model, and probably the most up-to-date in this country, it is expected that when the whole of the new tips are completed it will mean an increase in the coaling facilities of the docks of over a million tons per annum. Being of two kinds, fixed and movable, the tips are so arranged that it is possible to have at least two working into a ship at the same time. They have been designed to deal with wagons of 20 tons capacity, giving a gross load on the cradle of 30 tons, and with this load they will lift at the rate of 180 ft. per minute to a height of 60 ft., so that the largest ships may be easily loaded or bunkered. The cylinders are so arranged that if it is not necessary to lift a 20-ton wagon, ordinary 10 and 12-ton wagons may be dealt with at the same speeds, with a proportionate economy in the power required. Each tip has a 5-ton anti-breakage crane fitted with the company's special design of anti-breakage box, and also with a 3-ton small-coal crane which is capable of loading screenings from the deck of the ship and discharging through a hopper into a wagon placed on the quay wall.

These tips have several new features in addition to the higher speed and larger capacity. The cradle, instead of being worked direct by

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the rams, is suspended by wire ropes working over large overhead pulleys, giving a very easy and steady movement of the cradle. The tipping of the table is performed by another cylinder, the ram of which also operates through wire ropes, while the shute is manipulated by a special three-cylinder hydraulic engine placed on the top of the structure. By means of an ingenious arrangement of clutches, the same engine raises and lowers the top of the shute, raises and lowers the nose of the shute, and can also be used for slewing the nose horizontally 5 ft. in either direction.

All these movements are under the control of the topman, who has the necessary wheels and levers in his cabin. Designed and constructed by Messrs. Sir Wm. Armstrong, Whitworth & Co., of Elswick, to the specification of the company's engineers, each tip is provided with three-feed roads, each of which will hold a train of coal, and, in addition, a large group of sidings has been provided in the immediate vicinity for the accommodation of coal not immediately required. Construction has been hindered in consequence of the War, but progress is being made with the remainder, and when completed they will be a most important addition to the coal shipping facilities of the Bristol Channel.

London and North Western Railway "Patriotic Fête" at Wembley for Wounded Soldiers.

On Saturday, Aug. 7th a "Patriotic Fête" was held in the Wembley grounds of the "London and North Western (London) Athletic Club," the Company there entertaining nearly 200 wounded soldiers, some of whom have been in the railway's employ, and whose places were being kept open for them on their return from military service. All were conveyed to the grounds by motor cars. Mr. Guy Calthrop, General Manager, accompanied by Mrs. Calthrop, received the guests at the pavilion as they arrived. A varied entertainment was provided, and through the courtesy of Lieut.-Col. F. A. Cortez-Leigh music was rendered by the band of the Royal Engineers, Haynes Park Signal Depôt. During the afternoon the music was augmented in the "Cafe Rendezvous" by Bayston's Orchestra, and a vocal programme was provided by members of the London and North Western Railway staff.

In addition to Mr. Guy Calthrop, General Manager, many other officers of the Company were present. Mr. Cecil F. Grasemann, in the uniform of the Volunteer Reserve, and Mr. W. H. Pearce, were indefatigable in their attentions in their capacities of Chairman respectively of the Fête Council and the Fête Executive Committee, while Mr. J. F. Gee (hon. treasurer), Mr. D. H. F. Meacock (hon. secretary), and Mr. P. Skipworth (Press steward), were tireless in carrying out their duties. The work of arranging for such an event, which included catering for two or three thousand visitors as well as soldier guests, constitutes no mean undertaking, and the gentlemen mentioned, with the Council and Executive Committee, fully deserve the universal congratulations offered in appreciation of their energetic and capable preparatory and administrative duties. A large number of ladies assisted as honorary waitresses, programme sellers, Red Cross Fund collectors, and in many other ways.

Weather was unfavourable, but the rain held off sufficiently to avoid marring the proceedings, Arrangements included paper balloon ascents, Potato Race, Thread-Needle Race, "Turk Tickling," Pig-sticking, Cock-fighting, Blowing Toy Balloons, Cocoanut Shies, Aunt Sally, Quoits, Football, Dartboard Competition, Archery, Clock Golf, Bowls, Croquet and Lawn Tennis, all well supported, mainly by the soldiers, though other visitors could and did join in on payment of a small fee as far as was necessary to keep things going. As a rule, however, the soldier guests were ready for anything and everything, and neither crutches, arms in slings, nor bandaged heads were sufficient to deter them from taking full advantage of all that was available. For the competitions prizes were awarded to soldiers. The contests which attracted most attention were those for hairdressing and hat-trimming. For the former a number of ladies submitted themselves to the tender mercies of soldier competitors. The ladies and competitors then appeared before Mrs. Guy Calthrop as judge. The hat-trimming was restricted to soldier guests. Mrs. Guy Calthrop again acted as judge. This function was under the direction of Mrs. Pearce, who provided the hats, etc., and presented the prizes.

At 5 o'clock the soldiers sat down to a generous tea provided in a large marquee. Mr. Guy Calthrop, General Manager, expressed the pleasure it gave him and the Company to entertain such gallant guests. Sergt.-Major Kepner, a hero of the 1st Wilts, who has been wounded three times at the battles of the Aisne, Neuve Chapelle, and Hooges, and has received the D.C.M., replied. He requested "three heavy howitzers" for those who had so kindly entertained them, and the men responded with hearty cheers.

After tea a concert was given on the grounds, and at 7 p.m. dancing on the lawn (with a banjo party, under the direction of Mr. P. Strickland), but by this time most of the soldiers had gone home, by reason of being "invalids."

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STRATFORD-ON-AVON and Shakespeare's country, beloved of the American visitor, provides an admirable holiday haunt for English people who desire a change—never mind the reason—from the conventional seaside vacation. Besides the well-known Shakespearean associations, the birthplace of the national bard has much to recommend it as an inland holiday resort. The river affords an endless source of enjoyment to all who appreciate boating and its kindred sports, while the surrounding country, beautifully and typically English, appeals strongly to cyclists, motorists and sturdy pedestrians. In Stratford-on-Avon ample hotel and boarding-house accommodation is provided for an endless chain of tourists, and country lodgings at reasonable prices may be obtained in the adjoining villages. To assist intending visitors in obtaining suitable apartments a dainty booklet has been prepared and a copy can be obtained free of charge from Mr. A. E. Diggins, Traffic Manager, Stratford-upon-Avon and Midland Junction Railway, Stratford-on-Avon. Mr. Diggins likewise on application supplies particulars of trains and fares. The Stratford-upon-Avon and Midland Junction Railway is known as the "Shakespeare Route" and possesses connections with the London and North Western, Great Central and Midland Railways.

* * *

MR. JOHN A. F. ASPINALL, General Manager, Lancashire and Yorkshire Railway, has made application for the grant of £500 offered by Mr. W. J. Tatem, of Cardiff, to the captain, officers and crew of the second unarmed British merchantman to sink a German submarine. The s.s. *Thordis* was awarded the first of these grants offered by *Syren and Shipping*, and the new application is also being dealt with by our enterprising shipping contemporary. It is claimed that the master of the s.s. *Alt*—one of the Lancashire and Yorkshire East Coast vessels—sank a German submarine in June last. The *Alt* has since been examined in dry dock at Holyhead by Admiralty officials, preparatory to more detailed investigation.

* * *

FURTHER parties of Great Western men towards the formation of a Great Western Railway regimental company in a Constructional Unit of Railway Troops of the Royal Engineers, have been drafted into the Colours. On each occasion the men, before leaving Paddington, were assembled in the General Meeting Room to be officially given a few kindly parting words. Each draft consisted of about fifty men. The third draft left on June 25th, when Viscount Churchill, G.C.V.O. (Chairman of the Company), expressed to them his pride of the Great Western men who had already so nobly responded to the country's call, and said he was also proud of those present, who had volunteered for particular work. Mr. Frank Potter (General Manager) and Mr. W. W. Grierson (Chief Engineer) also spoke, endorsing the sentiments of the Chairman and expressing good wishes to the men. On July 2nd the fourth draft left. Viscount Churchill was again present and wished the men good-bye. Mr. Potter also wished the men good-bye and all success. The formation of the Great Western Railway "company" was completed by a further draft of men which left on July 6th. Mr. Ernest Palmer (G.W.R. Deputy Chairman) witnessed their departure, and wished them all good fortune. Mr. Grierson gave the men a parting word and kindly wish for their safe return.

* * *

THE first complete Railway Operating Corps formed by a railway company, that of the London and North Western Railway, has been completed, and the men left Euston to go into camp on Wednesday, July 14th. The Corps consists of three officers and 267 men; the officers and 227 men being recruited from the Traffic Department, and the remaining 40 men, consisting of drivers and firemen, from the Locomotive Department. The men assembled in the Half-yearly Meeting Room at Euston, on Tuesday, July 13th, to be addressed by Mr. Guy Calthrop, the General Manager, who was received with acclamation, and who gave them excellent advice and encouragement in their new undertaking, explaining that the Company would keep in touch with those they were leaving behind, and that their posts would be waiting for them on their return. The Corps left Euston in three batches for New Scotland Yard, where they were sworn in, and afterwards proceeded to Longmoor Camp for military training preparatory to crossing the water to assist their French and Belgian comrades.

* * *

THE new session of the Railway Club will open on Tuesday, September 21st, when the President, Mr. W. Parker, will give an

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address. Other arrangements include papers by Mr. C. A. Hunt on October 12th, "The Need for Economy in Passenger Train Traffic"; November 9th, Rev. W. J. Scott (Past President) on "The War's Ravages on British Train Services"; and December 14th, Mr. A. W. Bartlett, "The Great Eastern Railway Cambridge Main Line." Readers desirous of attending any of these are recommended to write to the Hon. Sec., Mr. E. J. Miller, at 92, Victoria Street, Westminster, who will also be pleased to forward particulars of membership.

* * *

In reference to an illustration of the "20th Century Limited," reproduced in the April Railway Magazine, Mr. W. G. Landon writes that the statement that the total weight of the train of eight cars is 541 American tons apparently includes the weight of the locomotive, is not correct. When the train is made up of seven cars, it weighs 541 tons *exclusive* of locomotive, as the usual weight of American 12-wheel steel cars is 75 tons. The approximate weight of cars in this case is: one club car, 83 tons; five Pullman sleepers at 75 tons each, 375 tons; one diner, 83 tons; total, 541 tons.

* * *

Last month we illustrated a flower receiving stall at Victoria station, Manchester, Lancashire and Yorkshire Railway. Now we reproduce a photograph of a similar stall which has been erected at Manchester (Exchange) station, London and North Western Railway. There is another stall at London Road, and they are staffed by voluntary helpers, who accept flowers from incoming passengers and arrange them in suitable bunches for conveyance to the various hospitals in Manchester and district.

Photo] [*Daily Sketch.*

FLOWER-RECEIVING STALL, EXCHANGE STATION, MANCHESTER, LONDON AND NORTH WESTERN RAILWAY.

* * *

The Hull and Barnsley Railway have issued two "Rolls of Honour." One applies to those who have joined His Majesty's forces. The company's coat of arms forms an attractive central feature, and the colouring is effective. The list is headed by the names of the Chairman (Col. Charles W. Trotter), Lieut.-Col. F. B. Moss Blundell (Assistant Solicitor), Capt. F. L. Pawley (Assistant Dock Engineer), Lieut.-Q.-M. Fred Wilson (Locomotive Department) and 2nd Lieut. J. Andrew (Audit Office). The "In Memoriam" Roll of Honour of those who have given their lives for their King and country is simple and dignified, printed in purple.

* * *

Speaking as Chairman at one of the open-air concerts of the annual Ilford Hospital Carnival, Mr. H. W. Thornton, General Manager, Great Eastern Railway, admitted that Ilford and other suburban districts of London served by the Great Eastern Railway have grown so rapidly in recent years that the company has reached the limit of its capacity to handle the local traffic. The greatest problem they would have to undertake after the war, he said, would be to provide some satisfactory way of handling the large amount of suburban traffic. Unfortunately, the war had caused a postponement of any definite movement in that direction.

* * *

Capt. E. O'Brien, R.E., Assistant Mechanical Engineer, Lancashire and Yorkshire Railway, and recently in command of the 111th Company, Railway Troops, Royal Engineers, has been appointed as Mr. Henry Fowler's assistant at the Ministry of Munitions. Mr. Oliver Winder, late Works Manager at Horwich, has been appointed to take charge of the Yorkshire district under the Department. All these officers received either the whole or the major portion of their training at Horwich, under Mr. J. A. F. Aspinall, then Chief Mechanical Engineer, Lancashire and Yorkshire Railway, and now for many years General Manager.

* * *

We regret to announce the death of Mr. W. Cuthbertson, General European Assistant, Grand Trunk Railway Company, at his residence, Liverpool, July 12th, following an operation. Mr. Cuthbertson, who was born at Caerlaverock, Dumfries, Scotland, March 8th, 1851, was in his early days connected with the Caledonian Railway and with the London and North Western Railway in Liverpool. Subsequently he accepted an appointment with the Canadian Express Company, Liverpool (May 19th, 1873), working his way up to the responsible position as Agent. That company being taken over by the Grand Trunk Railway, Mr. Cuthbertson continued the position of Agent, and for some

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time past, and at the time of his death, was General Assistant to Mr. Fred C. Salter, European Traffic Manager.

* * *

WRITING in reference to a recent paragraph on "Railway Traffic under War Conditions," Mr. T. Geary, of Leicester, mentions what he considers a unique example of varied make-up. A fish train arrived at Exchange station, Manchester, a few Sundays ago, hauled by a London and North Western Railway locomotive, and the load consisted of four wagons, namely, Great Central, Great Northern, Great Western, and London and North Western. For so short a train as this Mr. Geary suggests that "the extent to which a train can be composed of 'foreign' wagons has almost approached the limit."

* * *

OF ten new superheated "George V.'s" which have just commenced work on the London and North Western Railway, the following are now in regular main line service as follows:—363 *Llandudno*, 789 *Windermere*, 984 *Carnarvon*, 2153 *Llandrindod*, 2233 *Blackpool*, 104 *Leamington* and 226 *Colwyn Bay*. Nos. 363 and 984 are stationed at Bangor and No. 789 at Rugby. As will be seen by the numbers, the old 6 ft. 6 in. "Jumbo" 789 *Breadalbane* has been scrapped, and also another of Mr. Webb's 4-cylinder compound goods No. 363.

* * *

MR. S. A. PARNWELL, Land Agent, Great Eastern Railway, in his capacity of honorary secretary of the Great Eastern Railway War Relief Fund, has arranged to see any Great Eastern Railway men home on leave, who will call at Room 31A, General Offices, Liverpool Street Station. A "Call Book" is kept as a record of these visits.

* * *

THE Great Western Railway Directors have recently authorised the following new works: New booking office at Paddington for use of Metropolitan Railway. The provision of a hydraulic lift between the island platform and the subway at Hockley Station, Birmingham. A roadway to the up platform at Winchcombe for the accommodation of milk traffic.

* * *

THE Distinguished Conduct Medal has been awarded to Acting Sergeant W. Allen, 1/3rd (City of London) Battalion, Royal Fusiliers (T.F.) (formerly a shop labourer in the Locomotive and Carriage Department at Old Oak Common), Great Western Railway, for conspicuous gallantry, ability and resource at Neuve Chapelle from March 10th to 13th.

* * *

AT Bodmin the Great Western Railway yard has been re-laid and re-signalled. In reference thereto the Rev. J. B. Baron Collins writes that the old home signal was of the kind having a slot in the post for the arm, but the semaphore was pivoted outside, in accordance with more modern practice.

REFERRING to the reproduction of one of his photographs on page 123 of the August RAILWAY MAGAZINE, Mr. E. A. Gurney-Smith points out that the train is the Bournemouth–York express, at Boscombe station, London and South Western Railway (North bound), the special interest about it being that the train is composed of both London and South Western Railway and Great Central Railway coaches, with a London and South Western Railway dining car working right through to York!

* * *

MAJOR R. L. Wedgwood, R.E., Chief Goods Manager and Passenger Manager, North Eastern Railway, who has been acting as D.A.D.R.T. (in the Transport Establishment) in France, has been recalled for service at home.

* * *

CAPTAIN C. L. CONACHER, formerly of the Cambrian Railways, who is at present attached to the Ministry of Munitions, has been graded as Staff-Captain on the War Office Headquarters Staff.

* * *

RAILWAY Troops (R.E.) have been raised by the Railway Executive Committee for various duties with the Expeditionary Force in France in connection with work under the Director of Railway Transport. The total number of officers and men who have joined the corps up to the present time is 4,270.

* * *

AT the meeting of the Board of the Great Eastern Railway, Mr. Charles Edward Ellis, of Messrs. John Brown & Co., was elected a Director in place of Sir Arthur Tredgold Lawson, Bart., deceased.

* * *

MR. CHARLES WATSON, Chief Dock Engineer, North Eastern Railway, died on July 27th, at his residence at Tickton, near Beverley, Hull. Deceased, who was forty-three years of age, had been ill only a few days.

* * *

THE Right Hon. Lord Plunket, K.C.M.G., has been elected a Director of the Hull and Barnsley Railway in place of Sir Arthur Charles Lucas, Bart., deceased.

* * *

IT has been arranged by the employés of the Great Western Railway Locomotive Department, Cardiff, to maintain a bed in the Cardiff Hospital by a yearly contribution of at least 50 guineas.

* * *

A 4-4-0 LOCOMOTIVE, *Erin-go-Bragh*, has been placed in service by Mr. Cusack on the Midland Great Western Railway of Ireland, fitted with Robinson superheater. It is otherwise of the "Connemara" class. This engine now regularly works the 10.30 a.m. *ex*-Broadstone to Athlone, and the return service.

* * *

WITH the approval of the Board of Trade, the North British Railway Company have made a new bye-law prohibiting persons who intend to travel by any train which, in the course of its journey, crosses the Forth Bridge taking into

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the carriage with them any parcels or articles which, in the aggregate, exceed 20 lb. in weight. It reads as follows: "Any person intending to travel on the railway of the Company to a station beyond the Forth Bridge, or to a station short thereof, by a train which, in the course of its journey, crosses the Forth Bridge shall not take into, or caused to be placed in, any carriage or compartment of a carriage any parcels or articles of any description whatsoever, which, in the aggregate, exceed 20 lb. in weight. All parcels or articles in excess of said weight must be properly labelled and addressed with the name and address of the intending traveller, and must be handed over at the point where such person commences his journey on the railway of the Company, whether on a branch or main line, to an authorised servant of the Company to be placed in the guard's van for conveyance. Any person found infringing or failing to observe the provisions of this bye-law may be removed from any carriage or compartment of a carriage by or on the directions of any servant of the Company, and prevented from travelling by said train, and, in addition, shall be liable for every such offence to a penalty not exceeding £5."

* * *

THE Highland Railway branch line from Keith to Buckie has been temporarily closed for traffic. The railway staff affected comprises five stationmasters, a clerk, a pointsman, an engine driver, a fireman, a guard, and a dozen surfacemen, and the names of the stations now closed are Buckie, Rathven, Drybridge, Enzie, and Aultmore. Consequent on the closing of the line, passengers between Keith and Buckie will have to go by the circular route on the Great North of Scotland Railway, *viâ* Grange or *viâ* Elgin.

* * *

THE Great Northern Railway announce that from September 30th Holloway station is to be closed, and "arrangements made to deal with the traffic at other stations of the Great Northern Company."

* * *

MR. PATRICK MCCARTHY, General Manager, Listowel and Ballybunion Railway, controverts certain statements which had appeared in the *Irish Times* on the monorail line from Listowel to Ballybunion. The line (he says) has in a large measure helped to build up the now prosperous health resort of Ballybunion, which was only an insignificant village when the rail started 27 years ago, the owners having provided excellent golf links and good hotel accommodation; the line is self-supporting, and has never cost a penny to the ratepayers of the district which it serves; the monorail working has resulted for many years past in a substantial profit for the proprietors. This result has been obtained without Government subsidy, baronial guarantee, or imported management. Mr. McCarthy adds he thinks the railway compares very well with other lines in Ireland similarly or more favourably circumstanced, and fails to see how the monorail system or its working can be regarded as a failure.

ELECTRIFICATION of the Lancashire and Yorkshire Railway branch from Manchester to Bury, *viâ* Prestwich, is proceeding, but its completion has been considerably delayed by the war. The principal work that remains to be finished is the large power station which is being erected near to Clifton Junction and a small section of the track equipment leading into Victoria station. This scheme will afford a better service between Manchester and Bury, the intervening stations being Woodlands Road (Cheetham), Crumpsall, Heaton Park, Prestwich, Whitefield and Radcliffe, districts which for some time past have been developing. In normal times there are about sixty stopping trains each way on this branch line. The new electric service will mean a considerable addition to the number of trains, and the service will be greatly accelerated. The trains will consist of long wide corridor carriages of the saloon type, having accommodation for nearly 100 passengers. The northern suburbs of Manchester are becoming increasingly popular as a residential district, and the electrification of the line will, no doubt, give considerable impetus to its growth. Anticipating the demand for information, the Lancashire and Yorkshire Railway Company have issued an illustrated descriptive booklet of the districts served by the electric railway, and a copy will be forwarded free of charge on receipt of a postcard by Mr. A. Watson, Superintendent of the Line, Manchester.

WOMEN TICKET COLLECTORS READY TO GO ON DUTY, PHOTOGRAPHED OUTSIDE THE BAKER STREET OFFICES, METROPOLITAN RAILWAY.

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UNDER the auspices of the Royal Society for the Prevention of Cruelty to Animals, the fourth annual meeting of the Furness and Barrow branch was held in the Town Hall on July 29th. The Mayor (Alderman A. Barrow) presided. Mr. Alfred Aslett, General Manager, Furness Railway, speaking in place of Lord Richard Cavendish, dealt briefly with the report. In the course of his remarks he referred to the work carried out by the Society in connection with the war. The Royal Society for the Prevention of Cruelty to Animals is taking an important share in conjunction with the Army Veterinary Corps in looking after sick and wounded horses at the front, and thousands of animals have already been saved by the medical skill and attention provided by the Society. There are about 100 inspectors of the Society serving with the Colours, and the Society is providing allowances for their dependents. It is also incurring additional expenses in other ways during the present national crisis. In moving a vote of thanks to Mr. Aslett, the Mayor said he deserved everyone's thanks for the splendid services he had rendered as Chairman of the branch. If it was not for the personality, energy, and enthusiasm which he displayed in the work of the branch, it would not occupy the successful position it did, and so long as he could give his services as Chairman of the branch, so long would it be successful.

* * *

IN connection with the policy of centralising power for all the railways associated with the Underground Electric Railway Company of London, Ltd., the power station of the City and South London Railway at Stockwell has been closed down and current is now supplied from the Lots Road station. It is intended to supersede the Central London power station at Shepherd's Bush in the same way. The Euston sub-station of the "Hampstead" tube has been enlarged to receive two additional convertors for supplying the South London line, with other convertors at Old Street, Stockwell and Elephant and Castle.

* * *

IT is announced that the Ravenglass and Eskdale Railway is to be reopened as a "toy" railway. The line was formerly used largely in the summer time, but was closed some years ago. Now, it is stated, Messrs. Bassett-Lowke and Co. have obtained a lease of the line, and are about to reconstruct it on a model plan. The old rails are to be taken up, and a new line with a 15-in. gauge laid down. The locomotive will weigh 2 tons. The train is to accommodate some 90 passengers.

* * *

Two of the "Cardiff" class of 4-4-0 engines on the Great Western Railway, Nos. 3412 and 3413 (originally Nos. 3702 and 3703) now bear the names of two of the famous 7 ft. 8 in. "singles" of the 4-2-2 type. No. 3412 is *John G. Griffiths*, and No. 3413 *James Mason*. The former name was previously assigned, by re-naming, to No. 3060, originally styled *Warlock*. No. 3041 had been twice re-named. She was originally styled *Emlyn*, and was re-named *The Queen* when selected to haul Queen Victoria's special train from Windsor to Paddington and back for the Diamond Jubilee celebrations of 1897. Subsequently she was re-named *James Mason*.

* * *

CLOSER association between British railway companies since the war has been illustrated in many directions, particularly in the general interchange of rolling stock. London and South Western locomotives have frequently been seen working through trains on the Great Western line between Salisbury and Bristol; but on August 6th a more unusual sight was witnessed, a Midland six-coupled goods engine, No. 3460, hauling a troop train eastward over this section of the Great Western line. The train was composed of Midland and North Eastern coaches.

* * *

IN view of His Grace the Duke of Devonshire having been appointed a Civil Lord of the Admiralty, he has considered it desirable to resign several Directorships, which included the Chairmanship of the Furness Railway Company. In consequence of this retirement the following changes have been made on the Furness Railway Board:—(*a*) The Right Hon. Lord Muncaster, Deputy Chairman, has been appointed Chairman; (*b*) Mr. F. J. Ramsden has been appointed Deputy Chairman; (*c*) Mr. Myles Kennedy of Stone Cross, Ulverston, has been elected as a Director. It is hoped that in due course the Duke of Devonshire will return to the Furness Railway Board.

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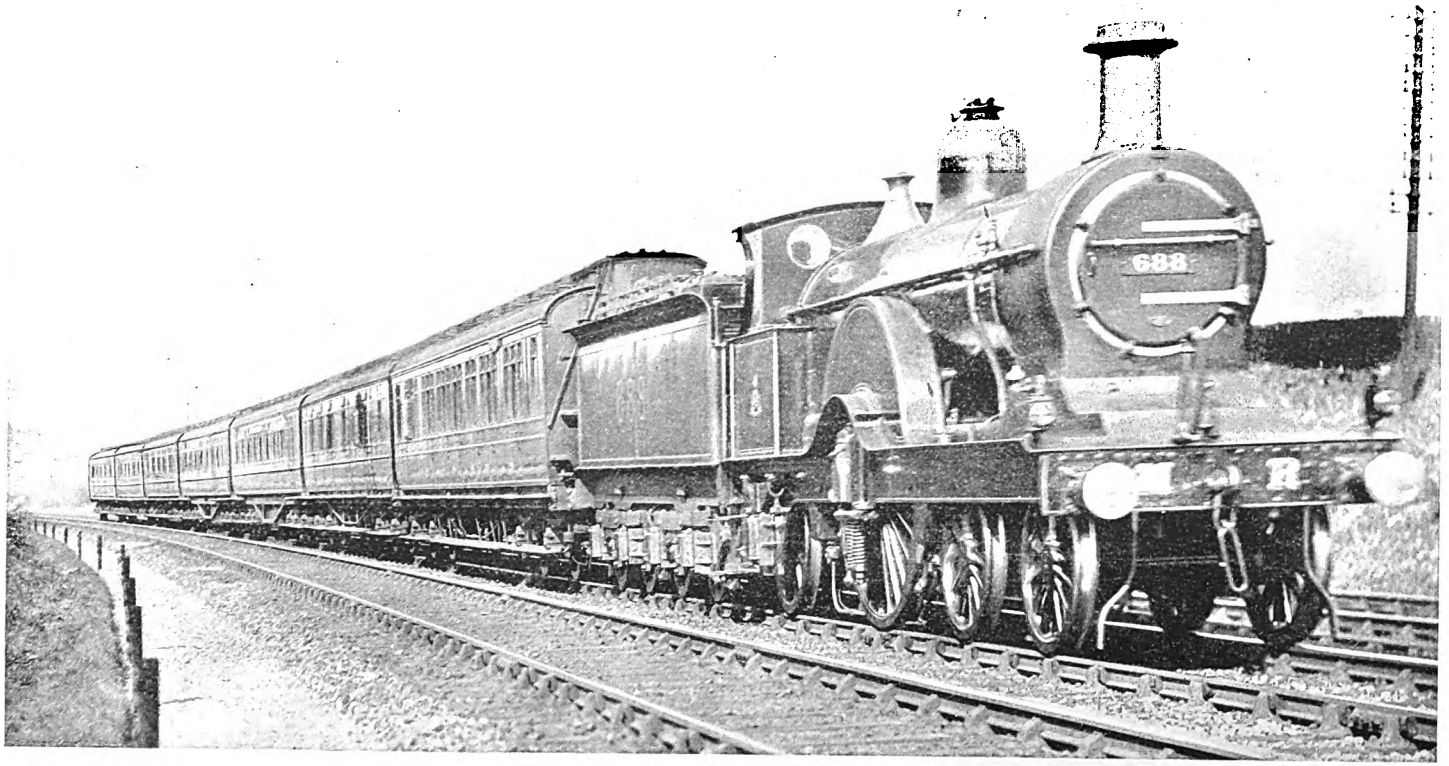

Photo] [*F. E. Mackay.*

MIDLAND RAILWAY.

Up Leeds and Bradford Restaurant Car Express.

4-2-2 Locomotive No. 688

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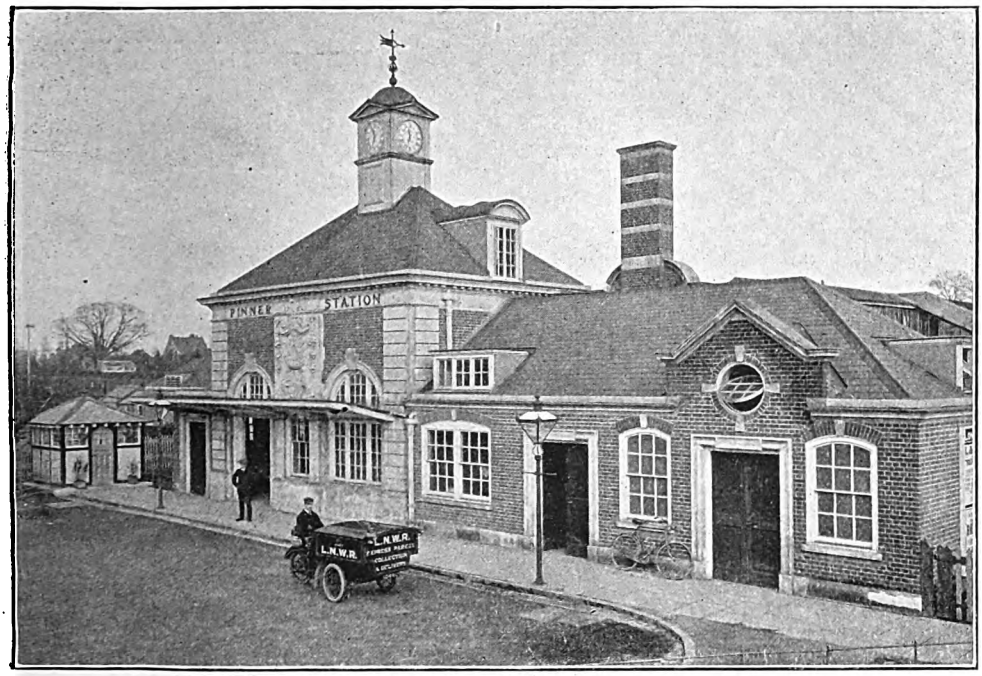

AN ARTISTIC EXAMPLE OF STATION ARCHITECTURE.
New Booking Office and Courtyard: Pinner Station.
Designed by Mr. Gerald Horsley.

The Engineer's Department of a Great Railway.

By J. F. GAIRNS.

IN early days one might almost claim that the engineer's department constituted the railway, seeing that the preliminary work of the engineer was the essential corollary to the obtaining of Parliamentary powers, raising of capital and the organisation of a railway company, while until the line was built and equipped the operative departments could not do more than prepare for the running of trains and the obtaining and working of traffic. Now, however, it is exceptional in this country for new railways of any considerable length to be built, and the engineer is concerned mainly with the maintenance, equipment and improvement of the railways as they are; with the construction of additional lines, widenings and new engineering works more or less as incidentals.

But while its original "supremacy" as evidenced by the fame of engineers such as George and Robert Stephenson, Locke, Brunel and others has gone, the engineer's is still necessarily one of the three or four "essential" departments, and the "Chief Engineer"—or as he is styled on some lines, the "Chief Civil Engineer"—occupies a very important and responsible position in the organisation of every railway of any magnitude. His is the responsibility for constructing, maintaining and equipping the railway upon which traffic is operated by the traffic departments by means of transportation machinery provided by the chief mechanical engineer; and on any large railway this becomes a most important undertaking.

Schemes of organisation differ on various lines, some in essential respects. For example, there are instances where the signal department is constituted independently,

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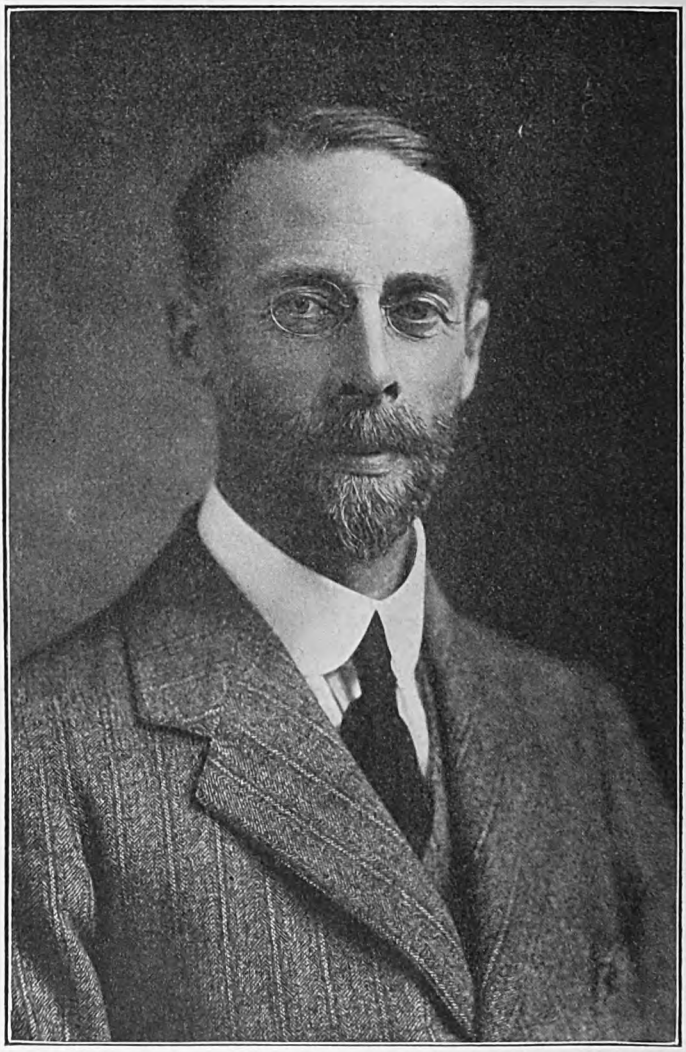

Photo] [*Elliott & Fry.*

MR. E. F. C. TRENCH, M.INST.C.E.

Chief Engineer, London and North Western Railway.

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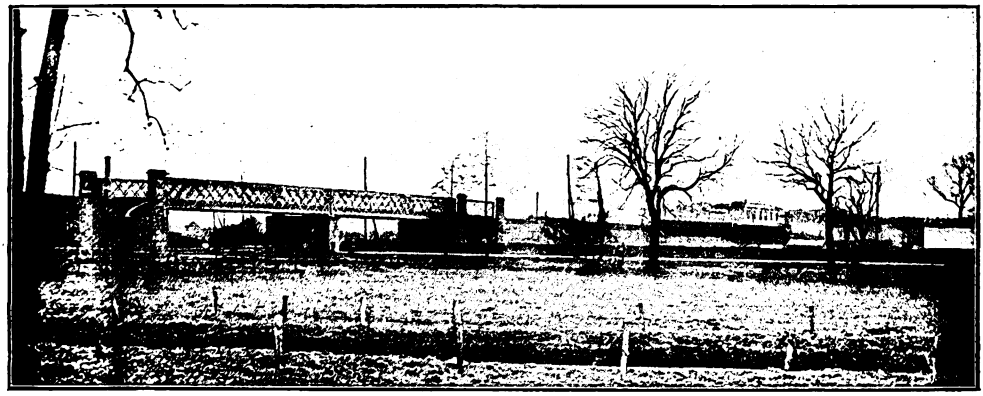
while the position of the electrical department is in many cases a somewhat anomolous one, as the activities of the electrical engineer now extend and overlap into several other departments. Special sections, such as those dealing with docks and harbours, canals, and occasionally with hydraulic machinery, lighting, etc., are also variously placed. On the whole, however, the chief civil engineer is responsible for all sub-departments which can be classified under the general heading of "civil" engineering, in all its recognised branches, and for several other sub-departments more appropriately associated with his department than any other, owing to the nature and application of their activities. On this basis the construction, maintenance and equipment of docks, harbours and canals is appropriately placed under his charge, while signalling, lighting and other special sections are usually organised so that the chief engineer is actually responsible therefor, though in practice some of these may be under the direction of more or less independent sub-chief officers.

In "Modern Railway Working" Mr. Cyril Hall presents a scheme of organisation for the engineer's department which gives three chief assistants—(1) maintenance, (2) new works, and (3) Parliamentary. The first-mentioned department is further subdivided as (*a*) administrative and clerical, (*b*) bridge, iron-work and steel-work, (*c*) permanent way, timber and rail, (*d*) architectural, (*e*) lighting, and (*f*) standardising; while through the administrative and clerical branch of the maintenance assistant's sub-department are derived the divisional engineers, with their staffs of assistants, surveyors, draughtsmen, and clerks, and the permanent way men and mechanics. Canal staffs are also associated with the maintenance engineer in the same way; but Mr. Hall omits altogether the position of the signal engineer, while it is difficult to understand why, if the canal department is to be selected for inclusion in a general scheme of organisation, the often more important dock and harbour departments should not be included even more prominently, seeing that railway companies are responsible for so many of the largest and best-equipped docks in the United Kingdom.

As a general statement, however, the scheme of organisation set forth by Mr. Cyril Hall is not very far out. The "maintenance" department covers virtually all the sub-departments concerned with the railway as it is. The new works engineer is responsible for new lines, widenings, etc., and the Parliamentary assistant looks after the preliminary stages of projected additions to the mileage of his railway and extensions of railway property, and watches proposals set forth elsewhere, besides attending to a hundred-and-one other matters associated with the extremely important Parliamentary aspects of railway engineering.



BRIDGE OVER RIVER AND STATION AT CROXLEY GREEN.

Descending to detail, however, the writer would suggest the following chief subdivisions as more nearly agreeing with the characteristic organisation found on most railways: (1) Parliamentary Assistant, placed first as his work is more particularly associated with the projected and preliminary stages. (2) New Works Assistant,

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responsible for new construction, placing of contracts, and oversight of work in hand. (3) Maintenance Assistant, with divisional assistants, having oversight of divisional staffs, and the permanent way men and track labourers. (4) Signal Assistant, if not organised independently. (5) Electrical Assistant, unless the development of electrical practice, especially for traction, necessitates a separate organisation under its own chief officer. (6) Dock and Harbour Assistant, a specialist on that side. (7) The Engineer's Accountant. It is not easy to exactly specify the positions of architectural, bridge, and iron and steel work assistants; they are probably best considered as chief assistants more or less on their own account, co-ordinated only by their positions under the chief engineer. At any rate, whatever their actual positions may be, they are necessarily specialists in their own branches of engineering, and their services may be required by any or all other sub-departments according to need. In some cases, too, the engineer may have his own workshops, and his own staffs of mechanics and shop labourers, while even if he obtains his "stores" from the stores department of the railway as a whole, he requires a staff whose duty is to deal specially with the ordering and supply of materials, fittings and other equipment, though they may be manufactured or produced through another department.

MR. W. DAWSON.
Assistant Engineer, Permanent Way, London and North Western Railway.

In practice, of course, strict departmentalism cannot be adhered to, for no modern railway could be carried on, in view of its multifarious activities and the wide scope of every large department, were every one to insist rigidly upon an exact and unavoidable interpretation of his duties. The engineer's department is, in fact, a combination of sub-departments, each under its own chief, who is responsible according to his special qualifications and position, and with further sub-departments as required, all mutually co-operating to do what is required under the co-ordination and instructions of the chief engineer himself.

Principal assistants may be variously styled. Thus, on one railway the chief engineer has Permanent Way, Parliamentary, Ironwork, Office and Architect Assistants, with the New Works, Signal and Electrical Engineers as more or less independent officers. In another case the Engineer-in-Chief has assistants for New Works, Maintenance, Telegraphs, Architectural Works, and Signals, with two or three divisional engineers only, instead of a larger number of district engineers responsible for smaller areas. In fact, virtually every railway has its own scheme of organisation, and often its own titles for the chief and assistant engineers, but in practice it usually amounts virtually to the scheme set forth above, except that certain departments may be constituted independently, with the corollary, however, that all engineering departments require to work together for the good of the railway, and with the ruling principle that there must be a clearly defined

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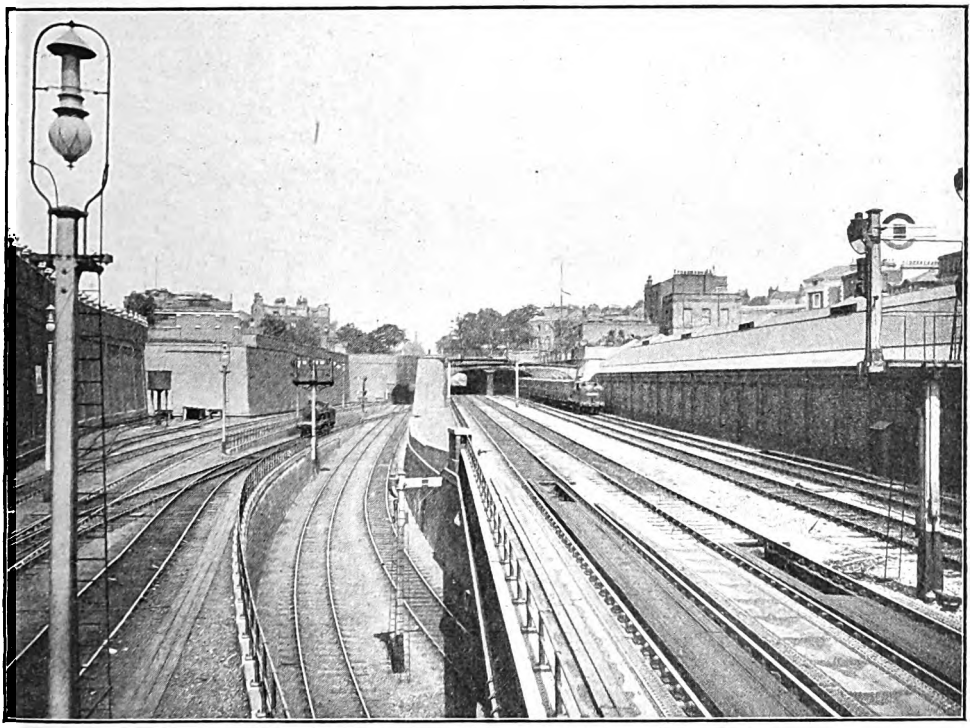
line of communication direct from the Board of Directors and the General Manager, to the Chief Engineer, and through the various assistants and sub-departments to every member of the staff.

So much by way of introduction. It will now be in order to deal with a concrete example, and for this purpose the writer is indebted to Mr. E. F. Crosbie Trench, Chief Engineer, London and North Western Railway, for particulars of the system of organisation adopted on what is often regarded as the "premier" railway. Mr. Trench occupies a unique position in that he can claim direct descent—in the "official" sense, that is—from George and Robert Stephenson, who on account of their work as engineers for the Liverpool and Manchester, London and Birmingham, Grand Junction and Chester and Holyhead Railways, may be regarded as the first chief engineers of the London and North Western Railway. Over the mantelpiece in Mr. Trench's private room at Euston there is, in fact, a portrait gallery including all the chief engineers who have preceded him. It is true that George and Robert Stephenson belong to the period before the London and North Western Railway came into existence under that title, though Robert Stephenson was Consulting Engineer to the London and North Western Railway from 1846 to 1859, but while they may be selected for special reference, Joseph Locke and the engineers of some of the other lines included in the amalgamation of 1846 might also claim inclusion. But the two Stephensons, father and son, form a distinguished commencement for the series—there are only five—completed by William Baker (1859–78), the first chief engineer of the London and North Western Railway as we know it, Francis Stephenson (1879–1902), and E. B. Thornhill (1902–9).



BURROWING CONNECTIONS BETWEEN EUSTON AND CAMDEN.

Mr. Ernest F. Crosbie Trench was born in 1869, at Ardfert Abbey, Co. Kerry, Ireland. He was educated at Monkton Combe School, Bath, and afterwards, for two years, at Lausanne, Switzerland. He entered the University of Dublin in 1888, taking the B.A. degree, and also the engineering degree of B.A.I. in 1892, the further degree of M.A. being conferred in 1903. Early in 1893 Mr. Trench commenced a term of pupilage under Mr. E. B. Thornhill, the late Chief Engineer of the London and North Western Railway. Part of this term of pupilage was spent in

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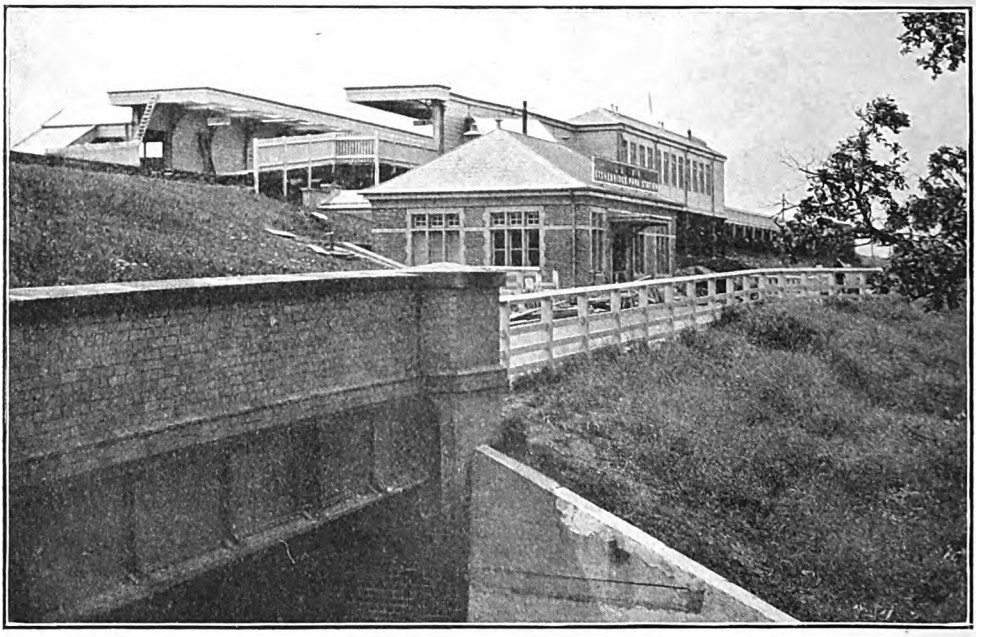
the drawing office at Euston, and in assisting in various works on different parts of the Company's system. In 1895 Mr. Trench was sent to Yorkshire to assist, first as pupil, and subsequently as an assistant, in the carrying out of a new line of railway between Huddersfield and Leeds. In 1899 he resigned his appointment to become a Resident Engineer on the Midland Railway, several important widenings and new lines being carried out under his supervision. One of these undertakings, the "Alfreton Second Tunnel," formed the subject of a paper read before the Institution of Civil Engineers in 1905. On the completion of these works, the post of Engineer to the North London Railway was offered to, and accepted by, Mr. Trench, in January, 1903, and during the three years he remained with that company a great deal of work was done in bringing the structures on the line up to the requirements of modern loads and traffic. In March, 1906, he returned to the London and North Western Railway, being appointed Assistant Engineer to Mr. Thornhill, and subsequently promoted to the post of Chief Assistant Engineer, this position being held until the retirement of Mr. Thornhill at the end of September, 1909, when Mr. Trench succeeded him as Chief Engineer. Mr. Trench has been for many years a member of the Institution of Civil Engineers, and has recently been elected a member of the Council.

The Engineering Department includes five principal divisions. Mr. W. Dawson is responsible to Mr. Trench for the maintenance of the railway itself, as Permanent Way Assistant. Mr. R. E. S. Cooper is New Works Assistant. Mr. J. T. Roberts has been Signal Assistant since, on the retirement some years ago of Mr. A. M. Thompson, the Signal Department was reorganised, and incorporated in the engineer's department. Mr. A. Donaldson is Parliamentary Assistant. Mr. Wynn-Owen is the Architectural Assistant. Euston is the headquarters of the Department, but the offices of the Permanent Way and Signal sections, under Mr. Dawson and Mr. Roberts respectively, are located at Crewe.



STATION BUILDINGS ON NEW WATFORD LINES AT STONEBRIDGE PARK.

The staff of the department includes normally about 5,500 platelayers, 6,500 artisans and labourers, and approximately 1,500 others of various grades and occupations. Of this staff of about 13,500, some 2,300 are now serving in His Majesty's Forces; about 250 men form the 115th Company of the new Railway Troops, Royal Engineers. This Company was the first to be recruited from the staff of a

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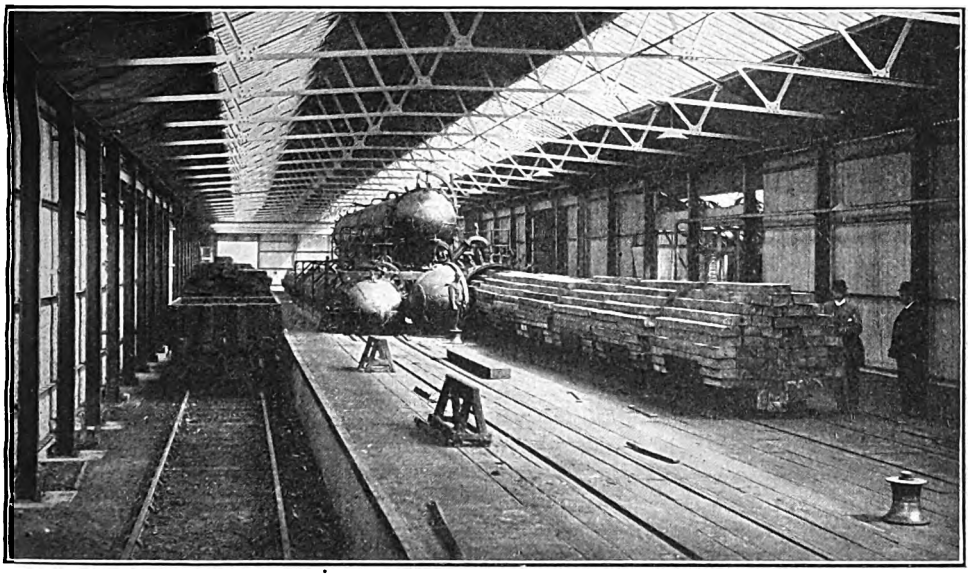
under his oversight. The resident engineers in charge of new works are directly responsible to him. Mr. Cooper has to his credit the new Watford lines, the Coventry loop line, the Abergele-Llandulas widening, and other undertakings of recent years.

Mr. A. W. Donaldson, as Parliamentary Assistant, deals with proposed new lines and other projects from the Parliamentary point of view, with the co-operation of Mr. Cooper and other chief assistants in regard to the preparation of plans, estimates, etc. He also watches and reports upon proposals from other sources as far as they require consideration in reference to London and North Western policy and projects. Mr. Donaldson is, of course, an experienced engineer, as well as an expert in Parliamentary procedure, and owing to the fact that he has had much experience of "tube" tunnelling, he is now responsible for the tube construction in progress on the London and North Western Railway. Tube tunnels are now being driven under Primrose Hill for the new "electric" lines, two separate "tubes" being constructed instead of an ordinary double-line tunnel. Another tube tunnel, about half-a-mile long, has been driven under Camden goods yard to facilitate the bringing of empty carriage trains to Euston, and two similar tubes have been completed at Kensal Green in connection with the electrification scheme; these are now in use by the "Bakerloo" trains which run to Willesden. Mr. Donaldson is also responsible for the main line widenings which connect these works, and for the complicated system of "fly-over" and "burrowing" junctions at Chalk Farm.

Mr. Wynn-Owen deals with all architectural work, station planning, buildings, etc. Most recent station reconstructions have been carried out to his drawings, including the improvements at Euston, now nearing completion, the new façade, the fine Booking Hall connecting platforms Nos. 6 and 9, and the new tea and dining rooms and refreshment rooms, features which are combining to render distinction to Euston, notwithstanding the drawbacks inseparable from piecemeal development. He is also concerned with the design of buildings, such as those for the new power station at Stonebridge Park, and the sub-stations for the electric sections; in fact, for all buildings except workmen's cottages and the hotels, which are dealt with otherwise.



CREOSOTING PLANT: DITTON CREOSOTING WORKS.

The Signal Department holds a somewhat detached position, the work being necessarily of a special character. Mr. Roberts is associated with Mr. Cooper, on new lines and widenings, and is in close touch with the Divisional Engineers and with the Traffic Department. Much of his material is made

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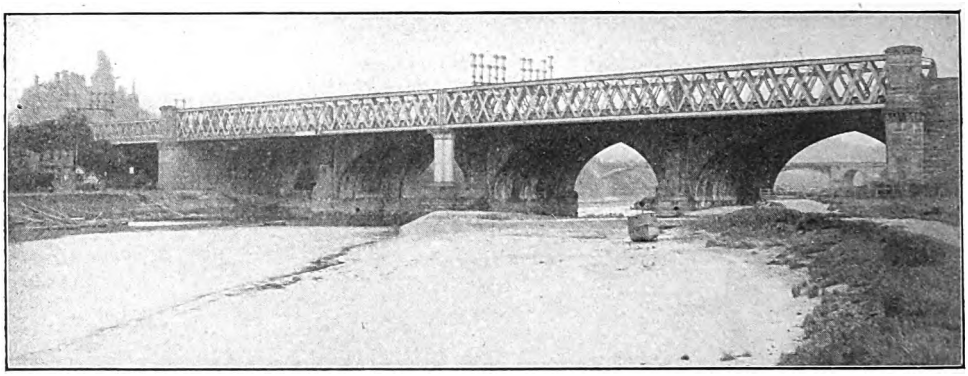
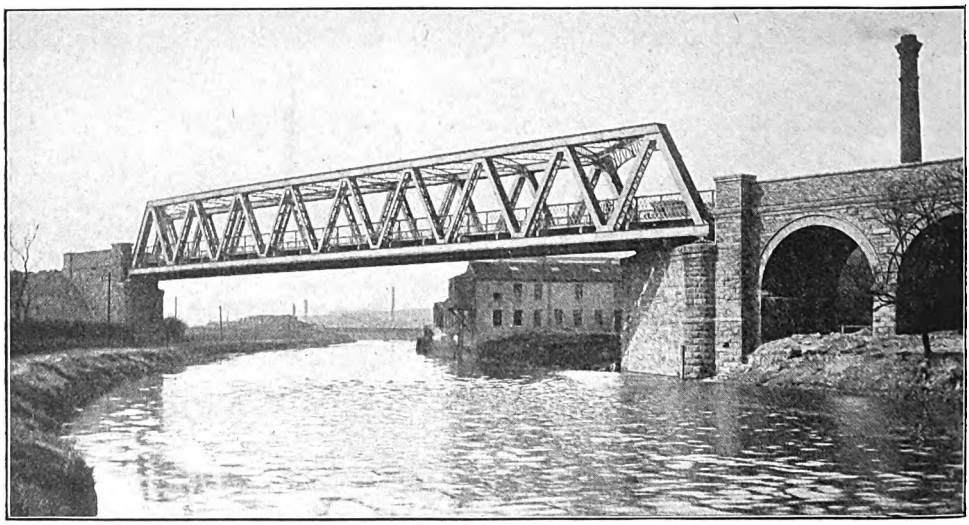


VIADUCT OVER THE RIVER RIBBLE, AT PRESTON.

by Mr. Bowen Cooke at Crewe Works, but he also has small shops at Crewe for general work. This department is responsible for the electric signalling at Crewe and Euston, also the signalling instruments, indicators, etc., used on the line, in addition to locking frames, signals, signal posts and gantries, etc.

Each of these officers has his own staff of assistants, and where necessary of draughtsmen and others possessing special qualifications. In the offices at Euston Mr. E. W. Hardman is Mr. Trench's personal assistant, while Messrs. Cooper, Donaldson, Wynn-Owen and Roberts are assisted as required by the nature of their duties.

At Euston there are large drawing offices where normally about 65 draughtsmen are engaged. Mr. Workman is chief draughtsman for general plans, etc.; Mr. Helsby for permanent way work and Mr. Stanton for bridge and girder work. At Crewe, Mr. Roberts also has a drawing office devoted particularly to signal work. Mr. Dawson has corresponding assistance at Crewe, and his own staff in the stores department, while the engineering accountant's office is also placed there. It will be seen that in several respects the London and North Western Engineer's Department does not agree entirely with the suggested scheme of organisation set forth; but it is very nearly equivalent, in practice, if not in theory, and includes several special features, some incidental—such as Mr. Donaldson's oversight of "tube" construction—others arising out of the fact that Crewe is a convenient centre, although the headquarters are in London.



BRIDGE OVER RIVER CALDER: HEATON LODGE AND WORTLEY LINE.

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Railway Returns for the United Kingdom.

In consequence of the War, summary returns only are issued by the Board of Trade, and it is stated that no further Returns will be published for the year 1914.

	1914.
MILEAGE OF LINES OPEN FOR TRAFFIC.	
Running Lines:	MILES.
First Track	23,701
Second ,,	13,403
Third ,,	1,648
Fourth ,,	1,277
Over Four Tracks reduced to Single Track	706
Sidings reduced to Single Track	14,928
TOTAL OF SINGLE TRACK INCLUDING SIDINGS	55,663
ENGINE MILEAGE.	
TRAIN MILES, including empty trains run for traffic purposes on either the forward or the return journey:	MILES.
Coaching	273,659,000
Goods	156,007,000
Mixed	666,000
TOTAL	430,332,000
SHUNTING MILES:	
Coaching	18,910,000
Goods	116,110,000
Mixed	59,000
TOTAL	135,079,000
OTHER MILES (Assisting, Light, &c.)	55,828,000
TOTAL ENGINE MILES	621,239,000
REVENUE RECEIPTS AND EXPENDITURE.	£
Total Receipts (including Miscellaneous Net Receipts)	139,098,000*
Expenditure	88,173,000
NET INCOME	50,925,000

* Including the estimated amount receivable by the Companies, under agreement with the Government, in respect of the control of British railways during the period from August 5th to December 31st, 1914.

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Locomotive and Train Working in the latter part of the 19th Century.

THE MANCHESTER, SHEFFIELD AND LINCOLNSHIRE RAILWAY. [No. III.]

(*Continued from page* 221, *September*, 1915.)

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

DURING the period prior to Mr. Sacré's resignation from the position of Locomotive Superintendent, the directors arranged with the London and North Western Railway to borrow one of Mr. Webb's 3-cylinder compounds. I think this was early in 1884, the engine being the one which had been used for trials on the London and South Western Railway between Waterloo and Exeter, viz., No. 300, *Compound*, one of the first or "Experiment" batch of compound engines. *Compound* made one trip with a Manchester, Sheffield and Lincolnshire main line train, and I was told that it went as far as Sheffield and back to Manchester. No particulars were ever published about this performance, and as nothing further came of it, it was probably returned to Crewe, as a nice, excellent engine with many good points, *but*——!

This was not the only compound engine to be tried on the main line of the Manchester, Sheffield and Lincolnshire Railway, for early in 1892, Messrs. Beyer Peacock and Co. constructed a large 7 ft. coupled "von Borries" two-cylinder compound express engine for the Dutch State Railways, and by permission of the railway company this engine was allowed to make a trial trip from Gorton to Penistone and back.

The foregoing particulars and notes bring this short record down to the end of Mr. Sacré's time. He was popularly reported on the line to know the details and little peculiarities of every individual engine on the railway. He was a thorough believer in double frames, and after trying single-framed engines for a few years, returned to his original opinion and from 1874 onwards built nothing but double framed engines, except his shunting tank engines. The following is a tabulated statement of the types of engines which were at work on the Manchester, Sheffield and Lincolnshire Railway at the time of his resignation.

Class.		Double frames	Single frames	Outside Cylinders
Passenger	2-2-2	—	—	12
,,	2-4-0	102	14	—
,,	4-4-0	27	—	—
Mixed	0-4-2	—	9	—
Pass. tanks	2-4-0	16	—	—
Goods	0-6-0	240	74	—
Shunting tanks	0-6-0	—	49	—
Dock tanks	0-4-0	—	—	7
		385	146	19
		550		

Two of Mr. Sacré's goods engines were illustrated last month. Of these No. 391 (see page 218) represents a class of 40 express goods engines, which worked most of the fast and heavy main line traffic between Grimsby, where most of them were stationed, and the principal stations on the line. They had 5 ft. 3 in. wheels, 17 in. by 26 in. cylinders, and the original boilers were pressed at 130 lbs. No. 466 (see page 220) is one of the last type, designed by Mr. Sacré (1880–85). These engines, 62 in number, had 4 ft. 9 in. wheels, 17½ in. by 26 in. cylinders, and in Mr. Sacré's time they also carried 130 lbs. pressure. They were and are still popularly referred to as the "Bulldogs." Mr. Robinson has been rebuilding these engines, but the 391 class, I regret to say, are now being broken up. These were built between 1874 and 1878, and may therefore now be considered to be beyond the age limit. In their day they were really excellent engines and were always very great favourites with the drivers.

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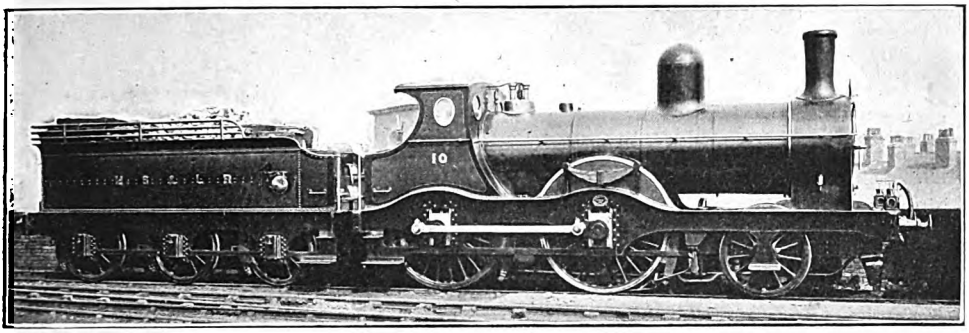
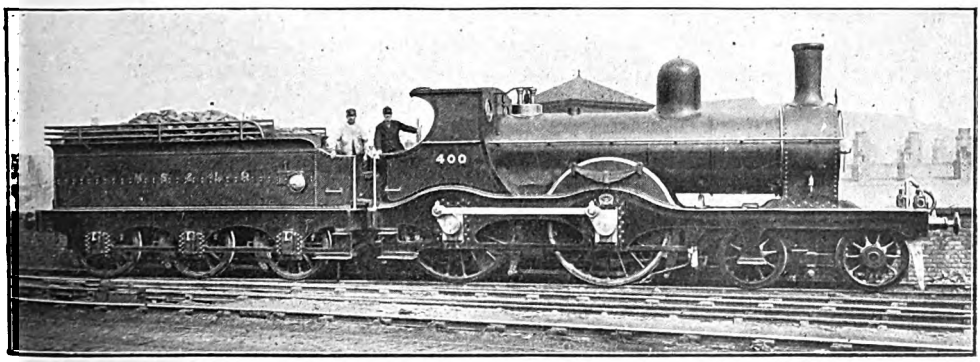


NO. 10 (NOW NO. 506), 2–4–0 EXPRESS LOCOMOTIVE (1887) WITH LEADING RADIAL AXLE.
Designed by Mr. Parker.

Some half a dozen of the inside framed goods engines of 1870–1 had two domes, *e.g.*, Nos. 61, 93, etc., of which class engine No. 61 was illustrated on page 213 last month.

The alterations in train services during the last ten years of the railway's existence as the Manchester, Sheffield and Lincolnshire Railway, do not call for much comment, as a fairly high standard had already been reached in the case of the Manchester-Sheffield-Grantham runs, and the improvements which placed Grimsby on the main line and gave it the benefit of one or two tolerably fast trains have already been dealt with. The 2.0 p.m. down from King's Cross, which was worked from Grantham by a Manchester, Sheffield and Lincolnshire engine was timed to leave Grantham at 4.4 p.m. and reach Sheffield at 5.12, a speed of 50 miles per hour, which of course had to allow for the severe slack round the Retford curve. This 68 minute timing for the 56·6 miles was really hard work, but in 1891 the allowance was reduced to 66 minutes, and the train was due at Sheffield at 5.10 p.m. Between Manchester and Sheffield in both directions the 59 min. allowance was adhered to, except that the 8.30 a.m. from Manchester was booked to cover the 41¼ miles in 58 min., and at one period the 2.0 p.m. from King's Cross, though nominally allowed 1 hour from Sheffield, as the public time tables gave its Manchester arrival at 6.15 p.m., was in reality booked to arrive at 6.13 p.m.—a 58 min. run. The 10.0 a.m. and 5.0 p.m. from Manchester were somewhat badly let down by the Guide Bridge and Penistone stops.

In 1890 a new 4.15 p.m. from King's Cross was timed to arrive at Sheffield at 7.29 p.m. and in addition had stops at Retford and Worksop in the 70 min. allowance from Grantham. This made this train harder to work than the 2.0 p.m. down. The Grantham-Retford run was booked in 38 min., a speed of 52·5 miles per hour. Finally about 1893, the 2.0 p.m. had another minute taken off the allowance from Grantham to Sheffield, and the timing reduced to 65 min. This, together with the



NO. 400 (NOW NO. 511), MR. PARKER'S 4–4–0 CLASS OF 1888.

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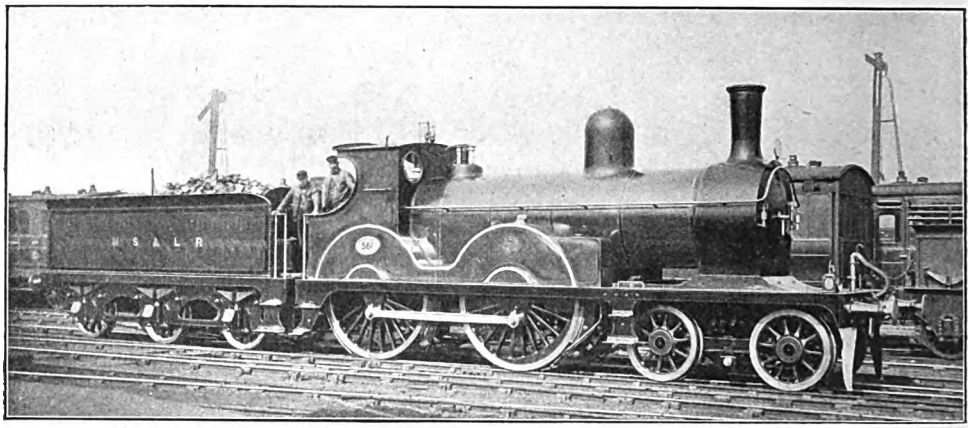

NO. 561 (KITSON & CO., 1887). EXHIBITED AT THE MANCHESTER EXHIBITION, 1887.

58 min. timing between Sheffield and Manchester, was the high water mark of the Manchester, Sheffield and Lincolnshire Railway main line as regards speed.

But the Cheshire Lines "went one better," and this with the 6 ft. coupled engines of the 539 class. A train leaving Manchester (Central) at 5.10 p.m. for Southport reached Birkdale, 48½ miles, at 6.5 p.m., a speed of 53 miles per hour. The Southport engines which made these runs were Nos. 39, 44, 48 and 49. The excellent Manchester and Liverpool service remained as before, but some improvement took place on the Manchester and Chester section. One train in each direction covered the 38¾ miles between the two cities in exactly one hour, with two stops of one minute each at Knutsford and Northwich. The Chester road was worked by Mr. Sacré's 6 ft. coupled engines, generally the 356 to 365 series, and sometimes one or two of the older 180 class stationed at Northwich.

Mention must now be made of the later types of engines introduced by Mr. Parker, who succeeded Mr. Sacré. In 1887 three 2–4–0 express engines came out from Gorton shops of a type which was then and has since remained quite unique. These were Nos. 10, 17 and 79, and had 6 ft. 9 in. wheels —the largest coupled wheels hitherto employed on a Manchester, Sheffield and Lincolnshire Railway engine—with 18 in. by 26 in. cylinders. No. 10 is illustrated on page 261. The peculiarity of this design was the combination of double frames and outside cranks for the coupled wheels, and an inside framed radial axlebox of the Webb pattern for the leading wheels. The pressure was 160 lbs. per sq. in. The year 1887 was that of the Manchester Exhibition, in which four or five large locomotives were shown by various railways and makers. It had originally been intended to exhibit No. 79 on behalf of the Manchester, Sheffield and Lincolnshire Railway and to that end the outside cranks and tyres were turned and polished bright. But Messrs. Kitson & Co., of Leeds, were also desirous of exhibiting a locomotive, and as the available accommodation was limited, it was eventually arranged that Messrs. Kitson should design and build an express engine for the Manchester, Sheffield and Lincolnshire Railway to be exhibited at Manchester. The result was No. 561, the first of the standard 4–4–0 express engines with inside frames and bearings. No. 561 had 6 ft. 9 in. wheels, 18 in. by 26 in. cylinders, and 160 lbs. pressure. Although the chimney, details and fittings were approved by the locomotive department at Gorton, it is but fair to say that the credit for the design lay entirely with Messrs. Kitson & Co., but it seems to have been arranged that their name should not appear on the engine itself, which bore no mark of its origin. A special number plate after the fashion of Mr. D. Drummond's earlier Caledonian and London and South Western Railway number plates was used, and this was the only Manchester, Sheffield and Lincolnshire engine with one of this pattern, for as soon as he took charge at Gorton, Mr. Parker proceeded to remove all Mr. Sacré's neat brass number plates and substitute transfer numbers. This "improvement," of doubtful value, did not enhance the beauty of the engines, and it was jocularly reported that Gorton was "hard up" for brass for other purposes. Mr. Parker's first design of chimney, as shown in the illustration of No. 10, was also, if I may be pardoned

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for thus expressing it, an eyesore, and a year or two later the neater design of chimney as fitted on No. 561 was adopted generally.

Engines 10 and 17 were immediately put to work on the Grantham runs; No. 79 sometimes ran to Grantham, but was frequently employed on specials, especially on the Cheshire Lines. I am obliged to admit that they were not particularly steady running engines, owing to the radial leading wheels, which practically left the guiding of the engines on the track to the coupled wheels only. However in this respect they were like the Great Eastern old 562 class, and Mr. Webb's compounds, all of which had Webb's radial axles at the leading end. The lateral steadiness depended upon the strength of the check springs of the radial axlebox.

After the termination of the exhibition, No. 561 was also put to work, with Nos. 10 and 17, on the Grantham trains, *vice* the three 7 ft. 6 in. Sacré singles, then sent to the Cheshire Lines. No. 561 was by a long way the best engine that had run the Manchester, Sheffield and Lincolnshire main line expresses, and did excellent work with them. I had several runs behind her, but I regret that I have lost the records.

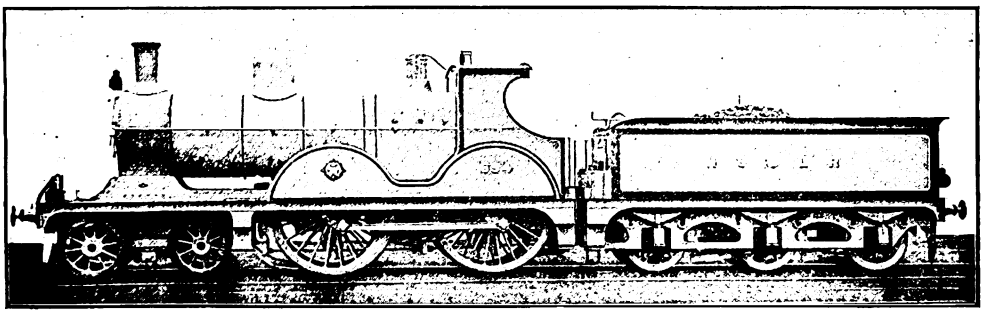
In the following year, 1888, Mr. Parker improved upon the No. 10 class by building three almost identical engines, Nos. 37, 89 and 400, in which the radial axleboxes were replaced by leading bogies. These were very good engines, and, together with No. 561, worked the Grantham trains for about three years until the end of 1890, when six more of the 561 class (562 to 567) were built at Gorton. From this time until 1895, the 561 class became the standard express engine and performed very good work.

Although Mr. Parker had, at the end of 1888, adopted Joy's valve gear as standard for all other classes of engines, the express engines always retained Stephenson's link motion. Nos. 562 to 567, 682 to 693, and 700 to 711—all of the 561 class—differed from that pioneer engine in having no sandboxes above the platforms in front of the driving splashers, and after running a few years both these and the special number plates disappeared from 561 itself. Nos. 700 to 711 were built by Messrs. Kitson & Co., in 1892, and this firm thus gained some reward for exhibiting five years previously at Manchester.

The 561 class are now on secondary work in general, Nos. 561 to 567 being mostly at Southport on the Cheshire Lines, 682 to 693 principally in the Grimsby district, whilst 700 to 711 are nearly all at Sheffield.

In 1893 a considerable number of engines were renumbered, when the 2–4–0 engines 10, 17 and 79 became 506, 507 and 509, and the 4–4–0 Nos. 37, 89 and 400, were renumbered 508, 510 and 511. They have since been rebuilt, several with Belpaire fireboxes, and some are now at Lincoln.

Mention has already been made of the almost entire absence of tank engines for passenger work from the locomotive stock of the Manchester, Sheffield and Lincolnshire Railway. In 1889 Mr. Parker began to remedy this by building at Gorton six "double end" 2–4–2 side tanks with Joy's valve gear. These had 5 ft. 7 in. wheels and 18 in. by 24 in. cylinders and 160 lbs. pressure. By the summer of 1893 there were 39 of these at work, of which 27 were built by Messrs. Neilson & Co. They displaced the small toy 5 ft. 6 in. tender engines in the Manchester and Sheffield districts, and the small engines then began to disappear rapidly. The new tank engines, and also a considerable number of 0–6–0 goods engines, had Joy's valve motion, but in 1894 a return



Photo] [*Loco. Publishing Co.*

NO. 694, 7 FT. 4–4–0 ENGINE OF 1895.

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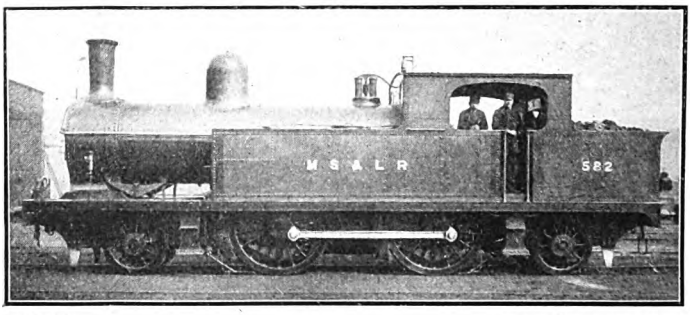
was made to Stephenson's link motion combined with rocking shafts.

The Manchester, Sheffield and Lincolnshire Railway had the honour of introducing the Belpaire type of firebox on to British railways in 1891, when they constructed at Gorton three 0–6–2 tank engines for goods traffic, of which the first was No. 7 (now 515). I am inclined to think that the germ of this idea came from "over the wall," *i.e.*, from the works of Messrs. Beyer Peacock & Co., which face the locomotive works of the Manchester, Sheffield and Lincolnshire Railway on the other side of the latter's railway. Belpaire fireboxes had been built in very large numbers at Beyer Peacock's works for nearly 20 years before Manchester, Sheffield and Lincolnshire Railway No. 7 appeared.

Finally, there remain the last batch of express engines, the 694 to 699 class with 7 ft. wheels, 18½ in. by 26 in. cylinders and 160 lbs. pressure. These came out in 1895 after Mr. H. Pollitt had succeeded Mr. Parker, but the designs were due to the latter gentleman, and were published in the *Engineer* of April 13th, 1894, some 12 months before the engines actually made their appearance. They differed from Mr. Pollitt's 852 class, built for the opening of the Great Central main line to London, in that 694 to 699 have slide valves working on inclined **V** faces, whereas the 852 class have piston valves.

Engines 694 to 699 immediately replaced the 562 class on the Manchester–Grantham services, and as they were the last passenger engines to be built for the Manchester, Sheffield and Lincolnshire Railway they bring this condensed account to a close. Nos. 694 to 699 are now stationed at Sheffield and work to Grimsby and Leicester, and also frequently run the one remaining Grantham train worked by the Great Central Railway engines, viz., the 4.48 p.m. from Sheffield, which consists of the Great Northern through corridor coaches worked on the Great Central Railway 3.40 p.m. from Manchester (London Road). During the war this train has been suspended.



Photo] [*Loco. Publishing Co.*

ONE OF MR. PARKER'S 2–4–2 TANK ENGINES.

Next month Mr. Ahrons will commence a series of articles dealing with locomotive and train working on the Great Western Railway during the corresponding period.

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British Locomotive Practice and Performance.

By CECIL J. ALLEN.

Photo] [*P. S. Koe.*

SOMERSET AND DORSET JOINT RAILWAY.

Stopping train on Chilcompton Bank.
Rebuilt 4–4–0 locomotive No. 71.

THE number of letters recently received from correspondents, as well as the time necessary for the preparation of the further tabular matter relating to superheater express locomotive proportions, promised in the last article, compel me to hold over the latter while I deal with the former. So the present article will be devoted exclusively to performance. In contrast to the runs given in the last two instalments, in which the work of various "Atlantic" type locomotives has come under review, the journeys about to be described were made entirely behind engines of the 4–4–0 wheel arrangement—that characteristically British "maid-of-all-work" type which still seems capable of performing efficiently a large proportion, if not the major proportion, of the express passenger work in these islands.

I will commence with one or two particularly fine runs of recent date on the Caledonian Railway. Coming on to the main down platform at Carlisle one evening a short while ago, with the intention of catching the 8.13 p.m. express to Glasgow—the heavy and popular 2 p.m. *ex*-Euston—I was considerably surprised to find at the leading end of the platform, waiting to "come on," not the mighty *Cardean*, but one of the original "Dunalastair II." class, No. 772. In common with many other engines of this type, this locomotive has recently received superheater equipment. The contrast in size, as the London and North Western "Claughton" came off the train, and No. 772 was attached, was indeed a striking one, and the latter looked positively diminutive against the lengthy train of seven 12-wheelers and three large 8-wheelers, the tare weight of which was 375 tons, and the gross weight, with passengers and luggage, not less than 395 tons. A thoroughly interesting journey was thus in prospect. No. 772 was in charge of driver John Short, whose able handling of the locomotive throughout was a matter for comment.

The start was brisk, as is always the case with north-bound trains from Carlisle, there being a short fall at 1 in 110 from the platform, followed by a very gradual descent from Kingmoor to the Solway bridge, just south of Gretna. On this initial length a speed of 62·5 miles per hour was attained, Rockcliffe, 4·1 miles, being passed in 7 min. 5 sec., and Gretna, 8·6 miles, in 11¾ min. Then followed the long "pull" to Brackenhill Summit. The first stretch of this is a continuous 7¼ miles at 1 in 200, and on this our minimum sustained speed was 44·1 miles per hour, the rate falling to 43·3 just at the top. On the mile down at 1 in 200, and the two miles of level past Kirtlebridge, we touched 56·3, and we then went up the culminating 4¼ miles at 1 in 200 to Brackenhill without the speed falling below 44·1 miles per hour. To Kirkpatrick, 13 miles, our time was 17 min. 10 sec.; to Kirtlebridge, 16·7 miles, 21 min. 50 sec.; and to

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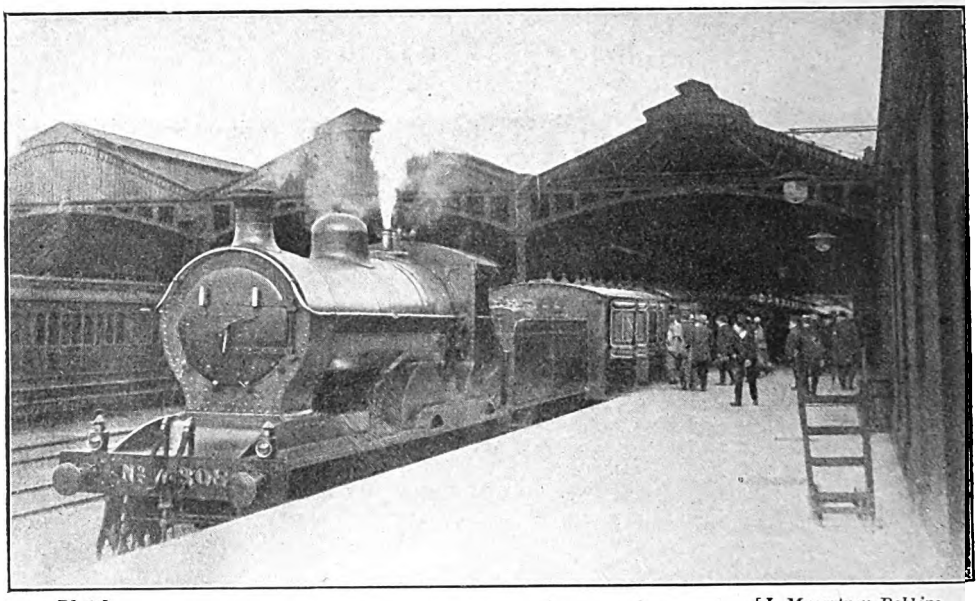

Photo] [*J. Macartney Robbins.*

GREAT SOUTHERN AND WESTERN RAILWAY.

3.0 p.m. Cork express at Kingsbridge Station, Dublin. Rebuilt 4–4–0 locomotive No. 308.

Ecclefechan, 20·1 miles, 25 min. 40 sec. From Brackenhill there is a brief fall of nearly 2 miles at 1 in 200, followed by a flatter grade of 1 in 528 for 5 miles past Lockerbie. On this descent our maximum sustained speed was 66 miles per hour, Lockerbie, 25·8 miles, being passed in 32 min. 5 sec., while the subsequent 8·7 miles to Wamphray were covered in 8½ min. From the crossing of Evan Water we went up 3½ miles at 1 in 206–200 without the speed falling below 44·1 miles per hour—a curious consistency this, on three separate inclines—and steam was then shut off for Beattock, which was reached in 47¼ min. from Carlisle. As the distance is 39·7 miles, and as, so far from being a "racing-ground," this section boasts a vertical rise of 480 ft. against down trains, driver Short's achievement was highly creditable, even though schedule time was exceeded by 2¼ min.

Thereafter the running called for little comment. As usual, we were banked from Beattock to Summit Box, this stretch of 10 miles taking 21 min. 25 sec. A speed of 32·4 miles per hour was attained on the ascent, and the minimum rate at the summit was 27·6 miles per hour. Very moderate speed followed on the falling grades thence to Lamington; the highest rate touched was one of 67 miles per hour near Crawford, after which the speed continued mostly at about 64, the 13·5 miles from Summit to Lamington occupying 13½ min. The short two-mile climb at 1 in 200 to Symington reduced our speed to 54·2 miles per hour, and we had attained a speed of 69·2 miles per hour on the falling grades beyond, when we were brought to a dead stand for signals between Thankerton and Carstairs. We had covered the 28·8 miles from Beattock to Symington in 38 min. 50 sec., and but for this check we should easily have reached Strawfrank Junction in a further 6¼ or 6½ min., so that our net time from Beattock to Strawfrank was not more than 45 or 45¼ min. Here again we had dropped 2 min. on schedule, but this was largely due to the cautious running from Summit to Lamington. A series of delays from Carstairs into Glasgow completely spoiled the remainder of the run.

This was not my only experience on the same day of the working of early Caledonian 4–4–0 engines. I was almost equally surprised in the afternoon to find No. 728, one of the first "Dunalastair" class, at the head of the 4.30 p.m. express from Glasgow to Manchester and Liverpool. The load, it is true, was only light, consisting from the start of five 8-wheelers and two 12-wheelers, weighing 216 tons empty, or 230 tons with

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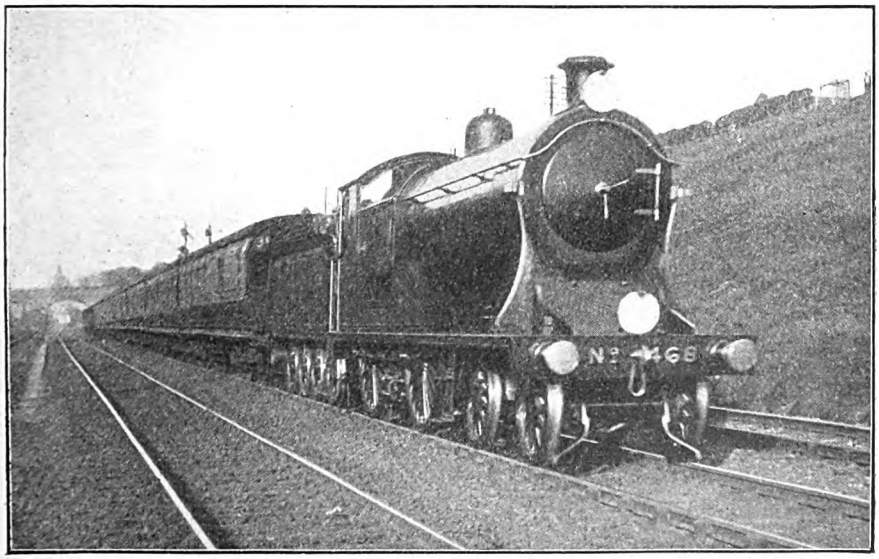
passengers and luggage, but once again the little engine did remarkably well. Starting briskly, we passed Rutherglen, 3·8 miles, in 6 min. 10 sec., despite a slight signal check, and then attained the mile-a-minute rate on the short descent beyond Newton. Motherwell, 12·8 miles out, was passed in 18 min. 50 sec., but from there to Carstairs the requirements of the working time table are so exceedingly moderate, no less than 28 min. being allowed for this 16 miles' ascent, that with the easiest running we economised 2 min. on this booking, reaching Carstairs in 44 min. 50 sec. from Glasgow. This time included the slight signal check at Rutherglen, a worse one at Cleghorn, and a permanent way check approaching Carstairs. Between Carstairs and Symington we were also severely checked by signals, and so left the latter place 2 min. behind time. The load, it should be said, had been reduced by 40 tons by the loss of the Lanark slip coach at Carluke, but at Symington the addition of the Edinburgh portion raised the total to 240 tons. From this point forward some fine running took place.

On the brief descent to Lamington our speed rose to 58·5 miles per hour, and this initial 3·7 miles was covered in 6 min. 10 sec. from the start. A speed of almost exactly 50 miles per hour was maintained right up the gradually rising grades—averaging 1 in 240 to 300—past Abington and Crawford, and the adverse 1¾ miles at 1 in 150 before Elvanfoot only reduced it to 48·4 miles per hour. The level mile past the latter station actually brought us up to 55·6 miles per hour, and we then climbed the 2¼ miles at 1 in 100 to Beattock Summit with no lower minimum than 40·2 miles per hour. Thus we had covered the 17·2 miles from Symington to Summit, almost entirely uphill, in the splendid time of 22½ min., having economised 1½ min. on schedule. Our descent of Beattock bank was rather more brisk than usual, a top speed of 77·5 miles per hour being attained, so that we completed the 27·2 miles from Symington to Beattock in the smart time of 32¼ min., start-to-stop. The booking for this stretch is one of 34 min.

Having dropped here the Moffat coach, so reducing our load to 205 tons, we made another very smart little run to Lockerbie, passing Wamphray, 5·2 miles, in 6¾ min., Dinwoodie, 11 miles, in exactly 12 min., and stopping at Lockerbie, 13·9 miles, in 15 min. 5 sec. The maxima on this stretch, the time allowed for which is 15 min., were 68·1 miles per hour at the bridge over Evan Water and 69·2 at Dinwoodie. As we were now well on time, there was no need for undue haste on the concluding section of the journey. A speed of 50 miles per hour was maintained on the ascent to Brackenhill Summit, after



Photo] [*H. E. Ambrose.*

LONDON AND SOUTH WESTERN RAILWAY.

3.30 p.m. down West of England express. 4-4-0 locomotive No. 468.

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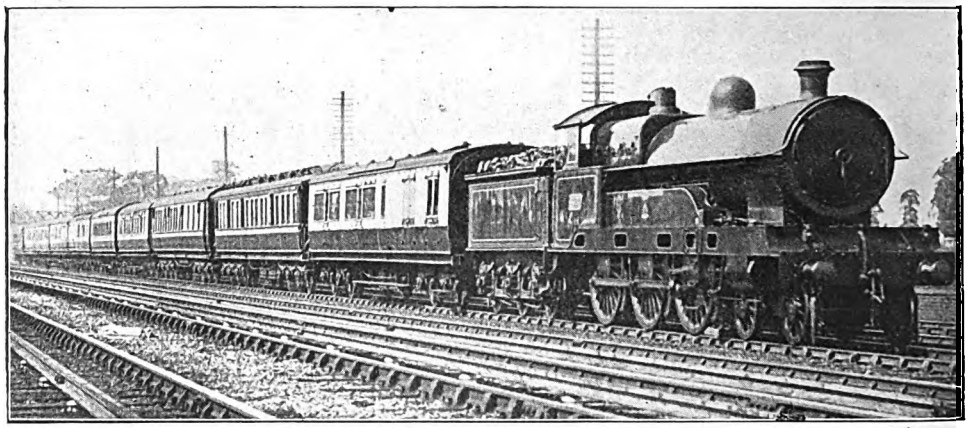

Photo] [*C. Laundy.*

LONDON AND NORTH WESTERN RAILWAY.

Up Liverpool Luncheon Car Express. 4-6-0 four-cylinder superheater locomotive
Alfred Fletcher.

which our rate rose to 66 on the 1 in 200 past Ecclefechan, and further to 71·4 on the succeeding and longer incline to Gretna. So Kirtlebridge, 9·1 miles, was passed in 11 min. 25 sec.; Gretna, 17·2 miles, in 19¼ min.; and we drew up at Carlisle just ½ min. before time, having covered the 25·8 miles from Lockerbie in 28 min. 25 sec., start-to-stop. For a small engine of what might colloquially be termed "uncertain" age, an actual running time of 75¾ min. for the distance of all but 67 miles from Symington to Carlisle—inclusive of time lost in stopping at and starting from Beattock and Lockerbie—was very praiseworthy.

From a correspondent living as remote from these shores as Burma, I have received details of a run behind No. 66, an engine of the rebuilt "Carbrook" class, and of very similar dimensions. The load from Carstairs in the latter case, however, was substantially heavier, amounting as it did to ten 8-wheelers and one 12-wheeled sleeping-car, weighing not less than 320 tons with an exceptionally heavy load of passengers and luggage. A drizzling rain was falling, and the rails were very greasy at the start; consequently 11 min. 10 sec. were required to cover the 6·6 miles to Symington. From there, however, the running greatly improved, the 11·6 miles from Symington to Crawford taking only 13 min. 35 sec., while the final 5·6 miles from Crawford to Summit accounted for 8 min. The whole climb of 23·8 miles from Carstairs to Beattock summit had therefore occupied 32¾ min. A cautious descent of Beattock bank followed, 10¼ min. being taken for the 10 miles, but good running ensued to Lockerbie, only 13 min. 10 sec. being required for this subsequent 13·9 miles' stretch. Onwards to Kirtlebridge the 9·1 miles consumed 9 min. 40 sec., but here a bad signal check was experienced, followed by a worse one at Gretna. Consequently the final 16·7 miles from Kirtlebridge into Carlisle occupied 18 min. 20 sec.; even then, however, the gross time from Carstairs to Carlisle, 73·5 miles, was only 84 min. 10 sec., or 81 min. net. Considering the fact that these engines are even smaller in the matter of dimensions than the first "Dunalastair" class, referred to in the preceding run, such work could hardly be bettered.

Another log enclosed by the same friend relates to the neighbouring "Waverley" route of the North British Railway, and is of no small interest as showing that the 4-4-0 engines of the latter company can on occasion display hauling powers in no degree inferior to those of the large "Atlantics." The engine in this case was No. 899, *Jeanie Deans*, of the large non-superheater type, the train the 9.30 a.m. from Edinburgh to Carlisle, and the load 159 tons empty or 170 tons gross. Bad weather was experienced throughout, fine rain making the rails greasy and a strong west wind hampering the running, while, in addition, the start was unpropitious, in that the train was stopped by signal for 4 min. when only 4¾ miles out of Edinburgh. This initial distance took

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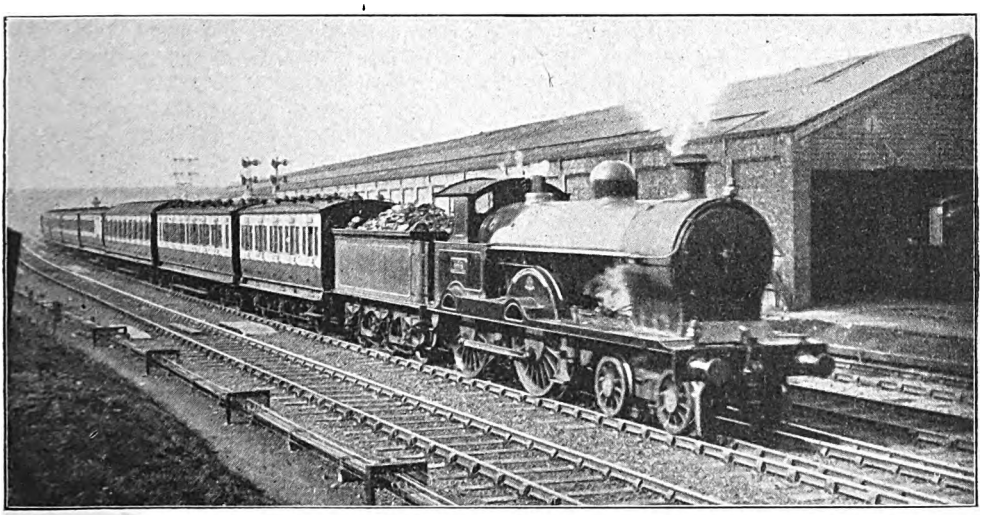
7 min. 25 sec., start-to-stop, and my correspondent estimates the cost of the delay, from contemporary runs, at 6¾ min. The stop took place at an unfortunate point, in that it was at the foot of the long ascent to Falahill, commencing with 3¼ miles at 1 in 175 to 250, and continuing with 8 miles, almost unbroken, at 1 in 70.

On this incline the speed varied curiously. The first 3 miles to near Gorebridge reduced the rate to 28·3 miles per hour, but the two very brief strips at a slightly easier inclination before Fushiebridge brought it up again to 31·7. On the continuous 3½ miles at 1 in 70 beyond the speed fell to 27·7 miles per hour, but then there was a remarkable recovery to 30 miles per hour, which was sustained for over a mile. The last complete ¼-mile of the ascent was run over at 32·7 miles per hour. So the 9 miles from Newtongrange to Falahill, entirely at 1 in 70 save the final 1¼ miles at 1 in 100, occupied 16 min. 55 sec., the time from Edinburgh to Falahill, 18 miles, being 35 min. 35 sec., inclusive of the stop, or under 29 min. net. The usual moderate running followed on the long descent to Galashiels, with frequent applications of the brake, the 8¾ miles from Falahill to Stow taking 9 min. 10 sec., and the 6¾ miles thence to Galashiels 7½ min.; the latter town, 33½ miles from Edinburgh, was thus passed, at much reduced speed, in 52¼ min., or 45½ min. net, from the start.

From Galashiels to St. Boswell's the 7 undulating miles took 8 min. 25 sec., and excellent running ensued on the rising grades thence to Standhill Summit, largely at 1 in 120 and 150, this distance of 6¼ miles being covered in 7 min. 5 sec., at an average speed of nearly 53 miles per hour. As a result of two signal checks, the next 6 miles down to Hawick consumed 7 min. 25 sec., and although the gross time from Edinburgh to Hawick, 52¾ miles, was as much as 75 min. 10 sec., the net time did not exceed 67¼ min. At Hawick the usual slack was made, with its hampering effect on the climb to Whitrope; the latter commences immediately, and continues unbroken for 11¼ miles, of which over 6½ are inclined at from 1 in 70 to 1 in 80. Nevertheless, *Jeanie Deans* recovered to 36 miles per hour on the easier grades, and did not fall below 32·3 on the continuous 3 miles at 1 in 75 past Shankend. Consequently the whole climb of 11¼ miles was accomplished in the fine time of 18¾ min., which gives an average speed throughout of exactly 36 miles per hour. Under such adverse running conditions this was really a remarkable achievement.

Once again a very cautious descent of the falling grades was made. The 10 miles from Whitrope to Newcastleton, mainly at 1 in 75, occupied 11¾ min.; the 7½ undulating miles thence to Penton, 7¾ min.; the 7 falling miles from Penton to Longtown, 7 min. 20 sec.; the 5¼ miles from Longtown to Harker, 5 min. 20 sec.; and the final 4½ miles into Carlisle, with a very cautious negotiation



Photo] [*F. W. Curtis.*

LONDON AND NORTH WESTERN RAILWAY.

Birmingham-London express passing Willesden. 4-4-0 locomotive No. 564 *Erebus*.

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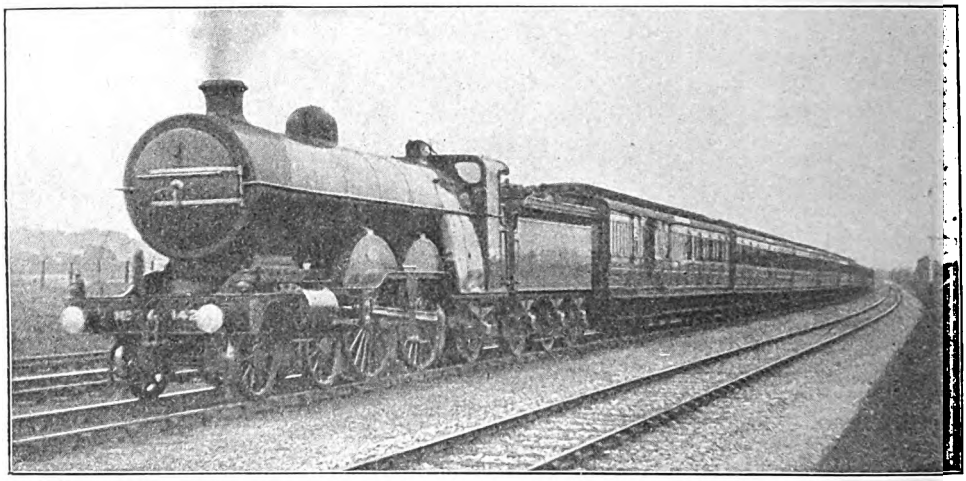

Photo] [*F. W. Curtis.*

GREAT NORTHERN RAILWAY.
Down Anglo-Scottish express. 4–4–2 engine No. 1426.

of the various junctions, 6 min. 20 sec. In this way, despite slacks all the way from Whitrope to Newcastleton, through Newcastleton and Penton stations and between Penton and Riddings Junction, and finally approaching Carlisle, the 34¼ miles from Whitrope into Carlisle had only taken 38½ min. The total time from Edinburgh to Carlisle, 98¼ miles, was thus 2 hr. 12 min. 25 sec., but if we deduct the cost of the signal stop and the two subsequent signal checks near Hawick, we get a net time of 124½ min. This average of 47·3 miles per hour over a mountainous road, and under adverse weather conditions, does the engine and its driver the greatest credit, especially in view of the fact that all service slacks were rigorously observed, and the falling grades were run over most moderately.

The magnificently-graded and aligned stretch of North British line between Edinburgh and Glasgow offers a remarkable contrast to the Waverley route, and over the latter I have lately enjoyed several good runs with the larger 4–4–0 superheater engines, which now work the "City to City" expresses exclusively. I will content myself for the present with describing two on the 1 p.m. express *ex*-Queen Street, Glasgow, allowed 62 min. for the 46 miles from Glasgow to the Haymarket station at Edinburgh. This train now loads quite heavily; on the first of the two runs the tare weight behind the tender was 286 tons, and on the second as much as 301 tons, corresponding to full weights of 300 and 315 tons respectively. Banking assistance is, of course, provided in rear up the celebrated Cowlairs bank to the station of that name. On the first run we passed Cowlairs, 1·4 miles, in 5¾ min., but accelerated very slowly on the slightly rising grades from there, the subsequent 4·7 miles to Lenzie taking 7¾ min., and the 6·6 miles on to Dullatur exactly the same time. Our speed was now 51·7 miles per hour, but on the easier grades to Falkirk the rate increased to a sustained 59·2, and the 9 miles from Dullatur to Falkirk only occupied 9¼ min. Immediately beyond Polmont we were badly checked for permanent way repairs, so that the 7·9 miles from Falkirk to Linlithgow took 10 min. 5 sec., but we picked up well from there, covering the 5·6 miles on to Winchburgh in 6 min. 35 sec., and the 8·5 miles thence to Saughton in exactly "even time." So we reached Haymarket from Glasgow without difficulty in 58¾ min., or 56½ min. net, the latter showing an economy of 5½ min. on schedule. The net time for the 37·6 miles from Lenzie to Saughton was a fraction under 40 min.

On the second trip the running was a little variable. It took us as much as 6½ min. to pass Cowlairs, while the 20·3 miles thence to Falkirk took us 25 min. 5 sec., as against 24¾ min. on the previous trip. But from Falkirk to Linlithgow we ran quite brilliantly, covering the 7·9 miles in 8 min., with a maximum speed of 63·8 miles per hour at Manuel. After Linlithgow we again suffered a bad permanent way check, from which we did not recover so well as before, the 16·4 miles thence to the Haymarket stop taking us 20 min. 20 sec. Even then, however, we

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had only occupied 59 min. 55 sec. on the journey from Glasgow, so that the net time of 57¾ min. still left an economy of 4¼ min. on schedule time to the credit of the engine. These runs are typical of performance on the Edinburgh-Glasgow section of the North British Railway, the express service over which is one of the most punctual in the country, although most of the trains might without difficulty be accelerated, as previously pointed out in these columns.

Curiously enough, my friend also sends details of a number of runs on the London, Brighton, and South Coast Railway, the performance of which occupied our attention in the last issue. It will have been noticed that two of the best runs then described—one in each direction—were made by 4–4–0 engines, and my correspondent's journeys further illustrate the excellent work performed by these locomotives. The first of his trips was made on the 3.50 p.m. express *ex*-Brighton, the engine being No. 61, and the load seven 8-wheelers and one 12-wheeled Pullman, 216 tons empty and 225 tons with passengers and luggage. Clayton Summit, 5 miles from the start, was passed in 8 min. 35 sec., and a maximum speed of 70·3 miles per hour was then attained on the brief descent to Wivelsfield. Hayward's Heath, 12·9 miles out, was passed in 16 min. 25 sec. The ascent to Balcombe tunnel did not bring the speed below 49·4 miles per hour, and a steady maximum rate of 75 to 75·6 miles per hour was then sustained past Horley; the times from Brighton were—to Balcombe Summit, 18·8 miles, 23 min. 5 sec.; to Three Bridges, 21·3 miles, 25¾ min.; and to Earlswood, 29 miles, 32 min. 20 sec.

Even the final 1 in 200 ascent past Quarry did not reduce the speed further than to 48·5 miles per hour; the summit, 33½ miles from Brighton, was passed in 37 min. 25 sec. from the start. Purley Oaks, 38·5 miles, was passed in 41 min. 50 sec., and, despite a slight signal check, Croydon, 40·4 miles, in 44 min. 10 sec. Adverse signals were then experienced at Selhurst, Thornton Heath, and Balham, but, notwithstanding all these, Clapham Junction was reached in 46¾ min., ¼ min. before time. Allowing for the various delays, however, the net time for the 48·2 miles certainly did not exceed 53 min. One of the features of this fine run was that the 32 miles from mile-post 44 to Purley Oaks were reeled off in 31 min. 5 sec., and this despite the fact that the distance in question includes 16 miles of adverse grades ranging from 1 in 264 to 1 in 200. Yet so easily were these grades negotiated that the engine was actually "blowing off" at each summit.

The other run was made under very different conditions, in that the load, according to Brighton reckoning, amounted to the unusual total of "= 28" vehicles. This was the popular 8.45 a.m. "first-class only" express from Brighton to London Bridge, with a Monday morning aggregation of four 6-wheelers, eight 8-wheeled first-class coaches, one 12-wheeled and three 8-wheeled Pullmans, 62 axles in all. My correspondent estimates the empty weight of the train at 356 tons, although this seems a somewhat unduly moderate figure; the full weight

Photo] [*A. Conville.*

LANCASHIRE AND YORKSHIRE RAILWAY.

0–8–2 tank engine No. 1501, used for banking and other special duties.

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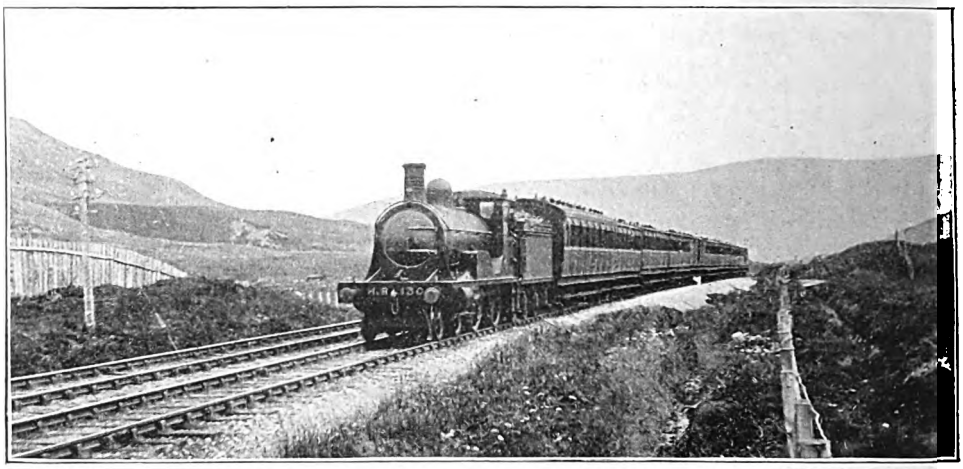

Photo] [*Tom M. L. Neish.*

11.50 A.M. PERTH-INVERNESS EXPRESS AT DRUMOCHTER PASS SUMMIT (1,484 FT. ABOVE SEA LEVEL).

4–4–0 locomotive No. 130 *Loch Fannich* (Mr. D. Jones' "Loch" class).

would work out at about 375 tons. The engine was No. 49, a 4–4–0 then styled *Duchess of Norfolk*, in charge of driver Young, who has since been promoted to the position of inspector. A slight check was experienced on starting, but Clayton Summit was breasted in 10¾ min., and the 7·9 miles thence to Hayward's Heath covered in 9 min. 20 sec. On the ascent past Balcombe a steady minimum speed of 40·9 miles per hour was maintained, Balcombe Summit being passed in 27 min. 50 sec., Three Bridges in 31¼ min., and Earlswood in 39¼ min. The 4·5 miles thence to Quarry Summit were covered in 7 min. 10 sec., and Croydon was passed in 53¾ min. from the start, practically on time. After this delays spoiled the remainder of the run. Although the journey was not a notable example of high speed running, the way in which the long inclines—moderate enough in inclination under ordinary conditions, but decidedly trying with a train of this weight—were surmounted was quite good.

A few months ago I gave in these columns an account of a particularly fine "Atlantic" run on the Great Central Railway between Sheffield and Manchester. More recently I was much interested by the performance of a 4–4–0 on the same train, practically tieing with the "Atlantic's" times throughout, and with a heavier load; the curious feature of the journey was the fact that the engine employed was not a "Director," but one of the earlier 4–4–0 engines, a number of which have now been provided with larger superheater-equipped boilers. The engine in question was No. 1038, the total load behind the tender being 210 tons to Penistone, and 155 tons beyond; the "Atlantic" had 30 tons less to the former point, and the same load beyond. Barely ½-mile from the Sheffield start commences the long ascent to Dunford Bridge, and at Oughty Bridge, after 4¼ miles up at 1 in 132, our speed had risen to 43·7 miles per hour, against the "Atlantic's" 40·9. But up the subsequent 5 miles at 1 in 120 we continued at the same rate, dropping fractionally, indeed, to 43·3, whereas the "Atlantic" accelerated to 44·1 miles per hour. Onwards to Penistone follow 3¾ miles at 1 in 131–160–100, and at the conclusion of this our rate had risen to 47·4 miles per hour; the "Atlantic," however, all but touched 50. Relieved of the respective slip portions, and with identical loads, the two engines then settled down to a steady 48·4 miles per hour on the final 5½ miles at 1 in 130–124–135 culminating at Dunford Summit.

The comparison between the times of the two engines on the climb are very interesting; they are as follows from Sheffield:—To Oughty Bridge, 4·8 miles, 4–4–0, 8 min. 40 sec.; 4–4–2, 8½ min.; to Wortley, 8·8 miles, 14¼ min. and 14 min. 10 sec.; to Penistone, 12·9 miles, 19 min. 40 sec. and 19 min. 35 sec.; and to Dunford Bridge, 18·9 miles, 27 min. 20 sec. and 27 min. 10 sec. respectively. Thus the 4–4–0 practically held its own with the "Atlantic" throughout. The cautious

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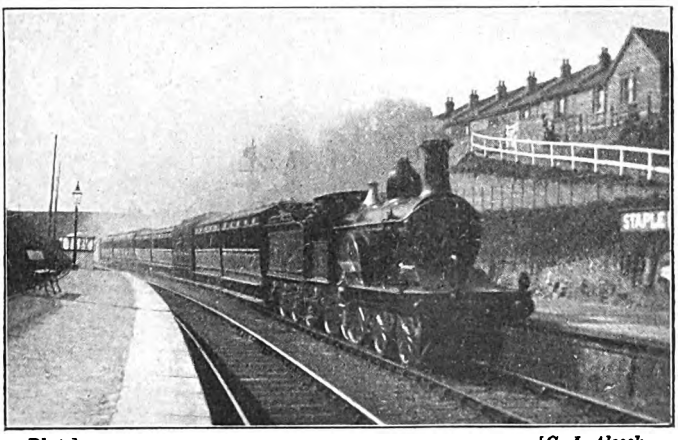
running necessary on the falling grades beyond Woodhead divests the remainder of the journey of much of its interest; it will suffice to say that we at no point exceeded 65 miles per hour, and covered the 3·2 miles from Dunford to Woodhead in 3 min. 35 sec.; the 7·3 miles thence to Dinting in 7½ min.; and the final 6·9 miles into Guide Bridge, inclusive of the customary slacks over Dinting Viaduct and through Godley Junction, and a permanent way check for Mottram widening, in 8 min. 20 sec. Our total time for the 36·3 miles was 46¾ min., exactly corresponding with that of the 4–4–2 engine, or 46 min. net, against 48 min. booked. Starting again from Guide Bridge, we passed Chorlton, 8 miles, in 9 min. 55 sec., and drew up at Central Station, Manchester, 11·1 miles, in 15 min. 5 sec., as booked, mantaining our "one-minute" Liverpool connection as a result of the first-class uphill work that had been performed.

In conclusion, perhaps I may be pardoned for once more referring to the 2.20 p.m. express *ex*-King's Cross, by which I have recently been travelling once a week, and which so far as the Great Northern Railway is concerned, has veritably proved to be a "lucky star" in the matter of successful runs. Beyond Grantham, indeed, if so vulgar an expression may be permitted, it has "come off every time." On a railway which boasts 116 large "Atlantic" locomotives, and a by no means overwhelming number of express trains on which to find them employment, it is a matter for some surprise to find a 4–4–0 engine booked to work one of the consistently heaviest expresses running on the main line. Yet such has been my experience with this train north of Grantham on the last three occasions on which I have travelled by it. For two of these three days the engine was No. 58, of the 4–4–0 superheater batch, and we will consider her exploits first.

The first of these runs followed on some rather feeble work from King's Cross, wherein No. 1402, large "Atlantic," with a train of 56 axles (388 tons empty, and 410 tons full) had, without delays of any sort, dropped over 5 min. on the 122 min. booking to Grantham. Then No. 58 came on, in charge of a driver whose name I forgot to ascertain, and made a fine effort to make good the deficit. A speed of 72·5 miles per hour was attained before Newark, and we covered this initial 14·6 miles in 15 min. 55 sec., the rate over the subsequent 6·3 level miles to Carlton not falling below 66 miles per hour. So Carlton, 20·9 miles, was passed in 22 min. 35 sec., and we then went up the 6¼ miles of Tuxford bank, of which 3½ are at 1 in 200, at a minimum speed of 41·3 miles per hour, passing Tuxford, 26·4 miles, in 28¾ min. To Retford, 33·1 miles, our time was 36 min. 35 sec.; to Bawtry, 42·2 miles, 45½ min.; and, maintaining a minimum of 42·5 miles per hour up to Piper's Wood, we should certainly have been through Doncaster in 54½ min. but for an annoying and very severe signal check at Balby. This unfortunately was the precursor of further checks all the way to York, so that at Doncaster all the interest of the run ceased. But to that point the 4–4–0 engine had recovered 3½ out of the 5 min. that the 4–4–2 had lost from London.

On the next occasion No. 58 was in charge of driver Brown, of Grantham, with a slightly heavier load of 58 axles, 397 tons tare weight, and 415 tons "in working order." The loss to be "made good" on this trip was even more substantial, No. 1433 having succeeded in losing 9¼ min. from town, in the proportion of 10 min. loss to Hitchin, 3 min. 5 sec. gain to Peterborough, and 2 min. 20 sec. further loss to Grantham. But this time No. 58 did not do so well, although, indeed, the work even then was beyond reproach, with this tremendous load.



Photo] [*C. J. Alcock.*

MIDLAND RAILWAY.

Bristol-Gloucester train passing Staple Hill, Bristol.

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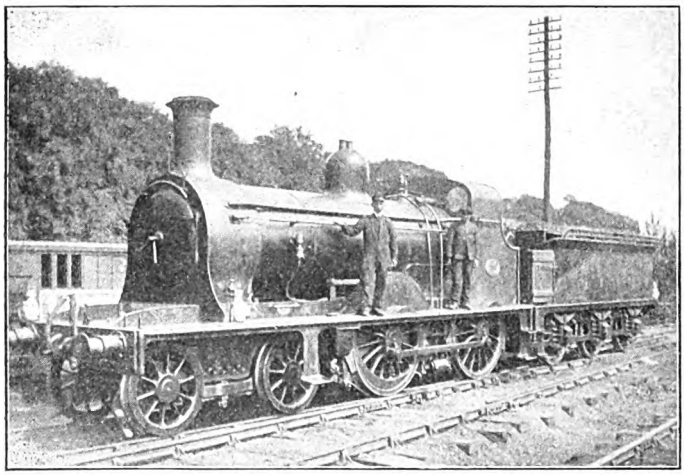


Photo] [*W. F. Anderson.*

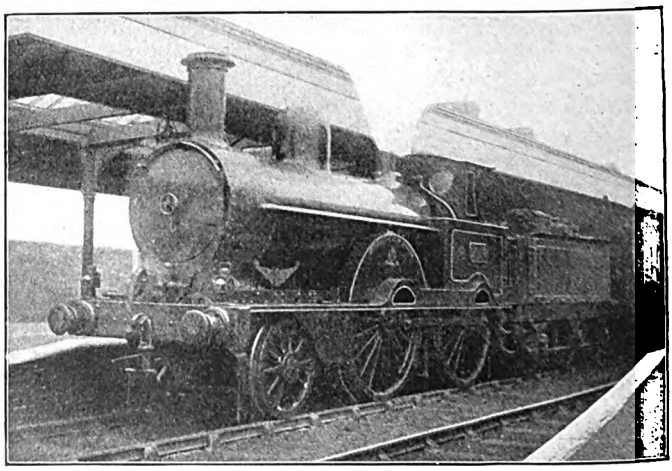
NORTH BRITISH RAILWAY.

No. 700 (Mr. Holmes' early "West Highland" class), at Galashiels.

Newark was passed in 17¾ min., Carlton in 23 min. 55 sec., Tuxford in 30¾ min., Retford in 39 min. 10 sec., Bawtry in 48 min., and Doncaster in 57 min. 10 sec.—50 sec. under booked time, but 2 min. 40 sec. over the time of the last run with a load only 5 tons greater. From there the 18·4 miles to Selby took 21 min. 50 sec., and the final 13·8 miles into York, commencing with the Ouse swing-bridge slack, and followed by some short but steep adverse grades, 18 min. Thus, whereas the "Atlantic" had lost 9¼ min. from London to Grantham, the 4–4–0, of much smaller dimensions in all respects save cylinders, had exactly kept the booked time of 97 min. from Grantham to York.

My surprise on the two runs just described at finding No. 58 waiting to come on at Grantham was nothing to the positive astonishment with which, on the next run, I found that our engine was to be No. 41, a small 4–4–0 of the preceding batch, with 17½ in. by 26 in. cylinders, 1,249 sq. ft. of heating surface, 20·8 sq. ft. of grate, and 170 lbs. working pressure—modest dimensions indeed for hauling a load of 425 tons over the grades of the Great Northern main line, even on its northern section, and without any assistance in the shape of superheater equipment. On this occasion No. 287, a large "Atlantic" in charge of driver Robinson, of Grantham shed, had done very well from London, with a still heavier train of 58 axles, weighing empty 402 tons, and with passengers and luggage at least 425 tons, as the train was full. We passed Hatfield in 28¾ min., thus losing 5¾ min. on the impossible time allowance, but by covering the 58·7 miles on to Peterborough in 55 min. 40 sec. we more than regained the arrears, and had thus ½-min. in hand. Further good work was done on to Grantham, which was reached in 121 min. 5 sec. from London, all but a minute early.

It was evident that driver Sharp, on No. 41, would have "his work cut out" to improve on this time-keeping record. Indeed, he did not improve on it, but for all that the work of the little engine was to me simply astounding, and decidedly above the average work of large "Atlantics" that I have timed under similar conditions of load. At Claypole our speed was a sustained 69·2



Photo] [*G. Milne.*

LONDON AND NORTH WESTERN RAILWAY.

2–4–0 locomotive No. 2006 *Princess* at Mossley Hill Station. This photo is of interest in that it was taken nearly 20 years ago, and yet, as far as secondary services are concerned, does not appear out-of-date, many of these engines still continuing at work.

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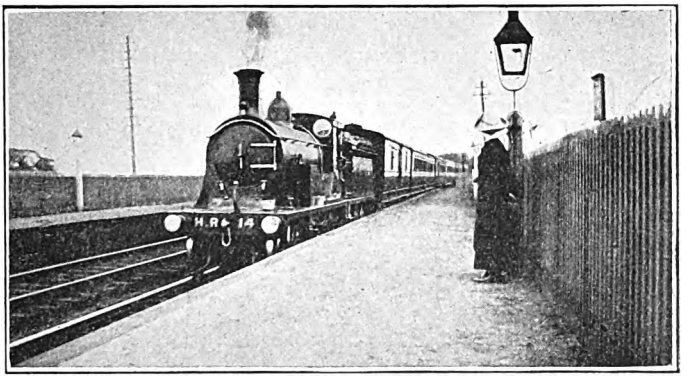
miles per hour, and we passed Newark in 17 min. 25 sec. Through Carlton, passed in 23 min. 20 sec., our rate was still 60, and we went up Tuxford bank with no lower minimum than 36·9 miles per hour. Descending to Retford we touched 64·3, and passed that station in 38½ min., Bawtry in 47¾ min., and Doncaster in 57¼ min., ¾-min. before time. Considering the moderate nominal tractive power of the engine, the work on the level beyond Doncaster was very good, the 18·4 miles on to Selby only taking 21 min. 20 sec.; the final 13·8 miles into York took 18¼ min., making our total time from Grantham 96 min. 50 sec. So driver Sharp had achieved the really notable feat of keeping time with a load of no less than 425 tons—an achievement under the circumstances that did both him and his fireman infinite credit. The only parallel that I have in mind to work of this character with a 4–4–0 engine is that which was performed until the advent of the larger 4–6–0 engines on the "Norfolk Coast Express" of the Great Eastern Railway; at summer week-ends this train often loaded to 14 or 15 bogie vehicles, and the Great Eastern Railway main line, even though the booked speeds are not so high, is of course vastly harder from the grading standpoint.



ABERDEEN-INVERNESS TRAIN PASSING WOODSIDE (GREAT NORTH OF SCOTLAND RAILWAY).

Worked by Highland 4–4–0 engine No. 14 (small "Ben" class).

On our arrival at York another version of the Carlisle episode took place, but in this case the contrast between the locomotive power detached and that attached was positively ludicrous. For the diminutive No. 41 of the Great Northern Railway was replaced by *two* vast North Eastern "Atlantics," Nos. 1776 and 2196, for the continuance of the journey to Newcastle. A comparison between the dimensions of the former and the aggregate in the case of the latter is amusing. The boiler of No. 41 has 1,249 sq. ft. of heating surface, whereas the two "Atlantics" boast 4,965 sq. ft., while the total grate area of the two giants was 54 sq. ft., against No. 41's 20·8 sq. ft. Further than this the cylinder volume of No. 41 is only 7·24 cub. ft., whereas the five cylinders of the "Atlantics" aggregate in volume 19·84 cub. ft., and, finally, the weight of the former is a modest 47½ tons against the 149 tons of the latter!

The work north of York was not altogether proportionate to the increase of tractive power—if it had been, we should have indeed broken all the world's records for speed!—but still, the two "Atlantics" did decidedly well. At York the load was increased to 69 axles, the tare weight of the whole being 471 tons, and as the train was crammed from end to end, the gross weight could not have been less than 500 tons. With this vast assemblage we passed Beningbrough, 5·5 miles, in 8 min. 40 sec.; Alne, 11·2 miles, in 14 min. 10 sec.; Pilmoor, 16·1 miles, in 18 min. 40 sec.; Thirsk, 22·2 miles, in 24 min. 20 sec.; and Northallerton, 30 miles, in 31¾ min. The speed rose to 65·2 miles per hour at Alne, and to as much as 68·1 at Thirsk. Beyond Northallerton we encountered a permanent way check, so that the 8·9 miles on to Eryholme took 9 min. 55 sec.; Croft Spa, 41·5 miles, was passed in 44¼ min., or 42¼ min. net, and we should have reached Darlington comfortably in 45½ to 46 min., but for a dead stand for signals outside the station, where, as usual, we remained for nearly 10 min. before finally crawling to the platform. The net gain on schedule time was thus 6 or 6½ min., but despite this the contrast between the work of the big "Atlantics" and the small 4–4–0 does the major credit, I think it will be admitted, to the latter. Indeed, I have specially chosen the runs with 4–4–0 engines which compose this article to show that, on lines where both 4–4–2 and 4–4–0 engines are employed, the latter can be relied on when necessary for performance in no degree inferior to that of their more powerful sisters.

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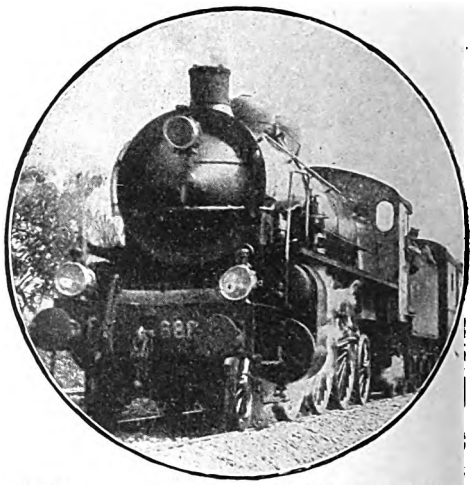
Italian State Railways Offices in London.



Photo] [*J. Macartney Robbins.*

ITALIAN STATE RAILWAYS.

2.20 p.m. Florence-Milan express near Florence, drawn by 2–6–2 four-cylinder locomotive.

IN view of the rapid development of tourist and commercial travel between the United Kingdom and Italy, it was desired some time ago—before war commenced, in fact—to open an information office in London on behalf primarily of the Italian State Railways, but to serve also as a centre where tourist and other information could be conveniently obtained, incidentally providing also for the principal steamship lines plying to and from Italian ports and for monetary exchange. Premises were acquired in a commanding position in Waterloo Place, Regent Street, London, S.W., and arrangements made for constituting in the one building a tourist booking, enquiry, information and exchange office, and part of the scheme was that the building should be decorated and equipped in accordance with Italian æsthetic ideas and with Italian material.

This project has been delayed in realisation owing to the war, several factors conducing thereto, one being the holding up of material then *en route* from Italy to England *viâ* France, and another the necessarily unsettled condition of affairs. Recently, however, as announced in our July number, the scheme reached fruition, and under the direction of Mr. William Stormont the office was opened for public use.

Mr. Stormont was for ten years engaged in the Continental Department of the South Eastern and Chatham Railway, but his experience has for a long period been devoted mainly to the Italian traffic, and he is familiar with almost the whole of Italy and with what our latest ally has to offer in the way of tourist facilities and attractions. He is, in fact, a whole-hearted enthusiast on the subject of Italy as a tourist and holiday ground, ready to combat some of the suggestions advanced, such as that the greater part of the country is only suitable for tours at certain periods of the year; and is well qualified to advise those contemplating a visit to Italy, not only from the tourist point of view, but also from commercial aspects. Mr. Stormont is, indeed, a strong believer in the future of Italian touring and in the development of travel between the United Kingdom and the commercial and tourist centres of Italy. He is assisted at Waterloo Place by a staff, most of whom are qualified in special directions—one as an art expert, another as a commercial adviser, a third is an authority on steamship services and facilities, and so on.

A feature of the new premises is the inclusion of a library of all works—in English as well as Italian—likely to interest prospective visitors or enquirants, and these are available for reference, as also a wide assortment of photographs and illustrations. The building is equipped on very appropriate lines, with a large reception room supplied with old Italian chairs, seats and tables. The ceiling was designed and moulded specially for the purpose in Italy, while the cabinet work is prepared from selected trees, some 200 years old. Decoration and equipment are in the Italian Renaissance style, completed by hanging lamps with bowls of Carrara

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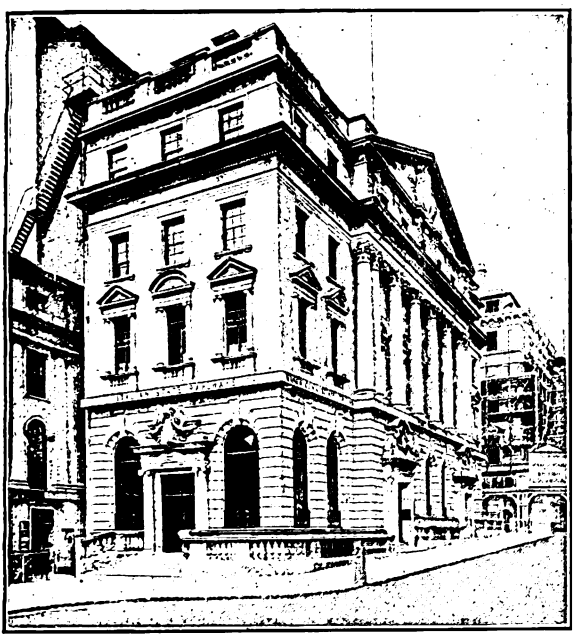

ITALIAN STATE RAILWAYS OFFICES IN WATERLOO PLACE, REGENT STREET, LONDON, S.W.

marble, replicas of Galilean lamps in Pisa cathedral.

Here in one building are concentrated all conveniences and facilities for anticipated developments in Italian travel. The office provides for the issue of all direct and circular tickets from this country to places in Italy and to the Italian frontier stations, also of local tickets (including tour and season tickets) on the entire system of the Italian State Railways. Also for the representation for the United Kingdom of the following steamship lines by which tickets are issued: *Italian Government Lines*. New vessels of 20 knots, from Naples to Palermo; also services from Civitavecchia to Porto Aranci (Sardinia), etc. *Società Italiana di Servizi Marittimi*. New fast mail steamers of 10,000 tons. Frequent sailings from Venice, Brindisi, and Naples to Egypt, Greece, Tripoli, Ægean Sea, the Near East, etc. The duration of the journey from Brindisi to Alexandria is less than four days; to Piræus, 40 hours. *Navigazione Generale Italiana, Italia, La Veloce*, and *Lloyd Italiano* Steamship Companies. These four lines have regular weekly sailings from Genoa and Naples to New York, Philadelphia, Boston, Montevideo, Buenos Ayres, Rio de Janeiro, and Santos, calling, according to service, at Barcelona, Dakar, Teneriffe, Trinidad, Colon, etc. The steamers are new vessels of 10,000 to 25,000 tons, and are the largest and fastest vessels in the South American service. The journey from Genoa to Buenos Ayres occupies fifteen days; to Santos, fourteen days; to New York, thirteen days.

Complete arrangements can here be made for journeys to Italy and by the above-mentioned steamship services—*i.e.*, time tables supplied, accommodation reserved (whenever possible), whether *de luxe* or ordinary places, on both trains and steamers, tours recommended, particulars of hotels furnished, and advice given by a competent staff.

Illustrated booklets of the chief towns and districts in Italy will be issued, together with publications of the Touring Club Italiano (guides, motoring maps, etc.), a highly organised and influential institution, available for purchase or consultation. The library includes books on Italy (descriptive,

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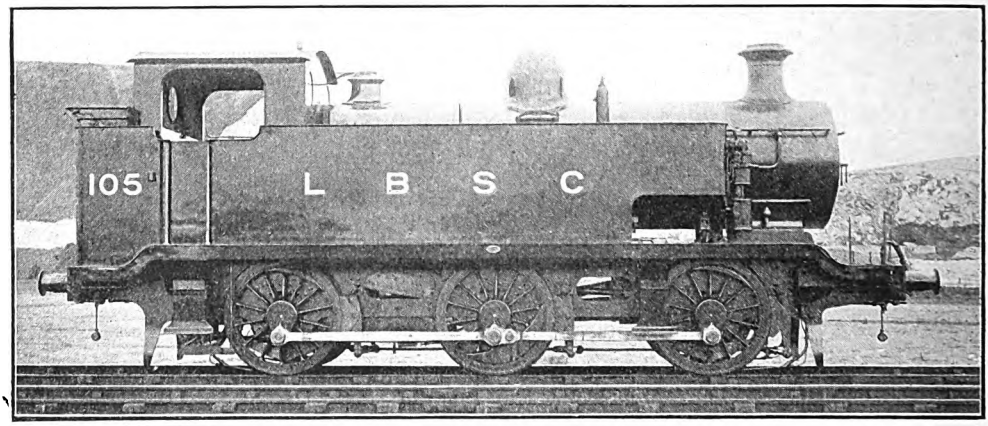
historical, architectural, artistic, etc.), by English and foreign authors, also Italian Government publications, may be consulted.

A branch of the *Banca Commerciale Italiana*, one of the foremost of Continental Banks, is installed in the same premises, through which every description of banking business may be transacted, including exchange of money (all currencies), issue of letters of credit, circular notes, Current Accounts, etc. The *Banca Commerciale* has 80 branches in Italy, and agents in all parts of the world.

In concluding, a few facts may be presented concerning the State Railways system of Italy. When in the year 1905 the railways of Italy passed into the hands of the State, the mileage was approximately 8,000; it is now over 9,000. There are a considerable number of private railways, all of secondary importance, being mainly small lines mostly with State subsidies. Their mileage is about 2,600. In addition to the above there are 7,500 miles of motor lines.

Rolling stock of the State Railways includes over 5,300 locomotives, upwards of 14,000 passenger vehicles and luggage vans, and about 104,000 goods wagons. Since the State took over the railways of Italy (1905), the passenger traffic has increased by over 75 per cent., whilst the goods traffic has advanced to the extent of 65 per cent.

NEW 0-6-0 TANK ENGINE: LONDON, BRIGHTON AND SOUTH COAST RAILWAY.



IN the RAILWAY MAGAZINE for September, 1913, a new series of 0-6-0 tank engines, known as class E2, then being constructed at Brighton Works, to the designs of Mr. L. Billinton, Locomotive Engineer, were described. They were intended for local goods and shunting work, superseding the well-known E1 class introduced by Mr. Stroudley in 1874, though it was proposed to utilise one of them for motor-train traffic, to run with two coaches at either end—a suggestion never realised as far as we are aware.

A further series of these engines has now been taken in hand, and by Mr. Billinton's courtesy we are able to illustrate the first of these. In general features they are identical with their predecessors placed in service two years ago; but the side tanks have been carried forward, thus giving a water capacity of 1,256 gallons, as against 1,090 gallons; while the maximum length over buffers is now 33 ft. 3 in., and the weight in full working order, 53 tons 12 cwt. instead of 52 tons.

Boiler, cylinders, motion, etc., are standard, and duplicate with those of other classes of engines on the line. The valve gear is of the "Stephenson" link type, with "D" slide valves, the cylinders and valves being lubricated by a graphite lubricator. Feed-water is heated in the side tanks by exhaust steam from the cylinders, and is delivered to the boiler by a "Weir" feed pump fixed on the front end of the left-hand tank. In addition, a combination injector of the hot water type by Davies and Metcalfe is fixed to the back of the firebox. The principal dimensions of the engines are as follows: Cylinders, 17½ in. diameter by 26 in. stroke; wheels, 4 ft. 6 in. diameter; working pressure, 170 lb. per sq. in.; heating surface—200 tubes 1¾ in. diameter 1,003 sq. ft., firebox, 97 sq. ft., total 1,100 sq. ft.; grate area, 17·35 sq. ft.; tank capacity—water 1,256 gallons, coal 2½ tons; maximum length over buffers, 33 ft. 3 in.; weight in full working order, 53 tons 12 cwt.

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Light Railways. [No. I.]

By HARRISON VEEVERS.

(*Parliamentary Assistant to Chief Engineer, Lancashire and Yorkshire Railway.*)

THE object of this article on Light Railways is to enable those interested in the subject, and more particularly those whose duty it is to prepare the necessary plans, particulars, etc., required in an Application for an Order to authorise a Light Railway, to have before them in a concise form the procedure which has to be adopted, under the Light Railways Acts, 1896 and 1912, and under the Rules of the Board of Trade issued from time to time under those Acts. The author has consulted various works on the subject, and has pleasure in acknowledging his indebtedness, more particularly to those by Seward Brice, M.A., LL.D., K.C., and Evans Austin, M.A., LL.D.

It is a difficult question to say in so many words what really constitutes a Light Railway. They are really undertakings of a public nature whose special incidents and characteristics are determined by the Light Railways Acts 1896 and 1912 and "Orders" of the Board of Trade based on these Acts authorise their construction. The provisions contemplated by the Acts as applicable to them would make them railways rather than tramways, but the special characteristics of any light railway will be determined chiefly by the Order itself. There is no definition in the Acts of the expression "light railways," and a light railway is, therefore, distinguishable from an ordinary railway mainly by reason of its being constructed under the powers of a Board of Trade Order, and having the special conditions given to the undertaking by that Order.

Light railways and light railway undertakings or companies differ from tramways and tramway undertakings or companies in the following respects, mainly :—

(1) Light railway companies have power to hold land, and if allowed by the Order, to acquire by compulsory purchase all such land as may be necessary for their undertakings.

(2) Light railways usually run wholly or partly over land belonging to themselves in private ownership, and not necessarily, if at all, on public highways.

(3) They are constituted by an Order of the Board of Trade, and do not necessarily require confirmation by Parliament, unlike a Provisional Order constituting a tramway undertaking, which requires the sanction of Parliament.

Under the Act of 1896 the Board of Trade were not required to confirm an Order made by the Light Railway Commissioners if they were of opinion that by reason of the magnitude of the proposed undertaking, or of the effect thereof on the undertaking of any railway company existing at the time or for any other special reason relating to the undertaking, the proposals of the promoters ought to be submitted to Parliament. Under the Act of 1912 the Board of Trade may, if they think fit, submit the proposals to Parliament by bringing in a Bill for the confirmation of the Order. Only in this case is the sanction of Parliament required to an Order under the Light Railways Acts.

Section 10 of the Light Railways Act, 1896, is to the effect that the Board of Trade may confirm an Order made by the Commissioners with or without modifications as the case may require, and an Order so confirmed shall have effect as if enacted by Parliament.

(4) An Order may incorporate the persons obtaining it, which cannot be done by a Provisional Order in respect of a tramway undertaking. This means, to set up a company with perpetual succession and a Common Seal, whereas for tramways the company must be formed under the Joint Stock Companies' Acts or created by Act of Parliament.

(5) The general Acts of Parliament relating to railways will apply to a light railway as they apply to any other railway, but the Clauses Acts, by which are meant

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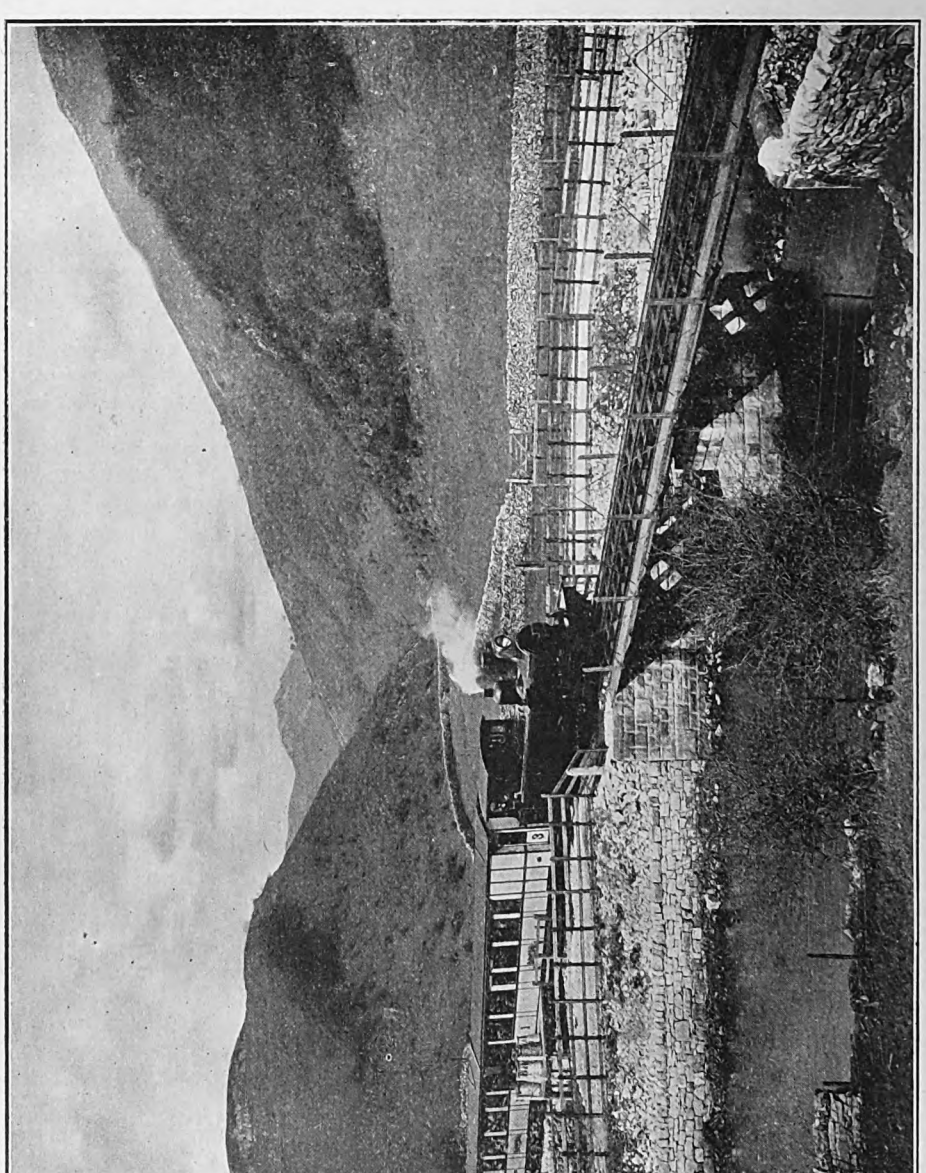

Photo] LEEK AND MANIFOLD LIGHT RAILWAY TRAIN IN CHARACTERISTIC SURROUNDINGS. [Harrison & Sons.

This line is worked by the North Staffordshire Railway Company.

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the Lands Clauses Acts, the Railways Clauses Consolidation Acts, 1845, and 1863, and the Companies Clauses Consolidation Acts, 1845 to 1889, are not to apply to a light railway authorised under the Light Railways Acts, 1896, and 1912, except so far as they are incorporated by the Order authorising the railway.

Usually a Light Railway Order incorporates the Railways Clauses Act, 1845, except the following Sections :—

Section 11.—Limiting the vertical deviation to 5 ft. except in a town, village, street or land continuously built upon, and then only 2 ft.

Section 13.—Referring to viaducts, tunnels, etc., to be made as marked on the deposited plan.

Section 14.—Limiting alterations to gradients and curves of railway.

Section 15.—Limiting lateral deviations.

Section 46.—Restrictions on level crossings of roads.

Section 47.—Making it compulsory if the railway crosses public roads on the level for the company to erect gates.

Section 48.—Trains not to cross roads adjoining stations at more than four miles an hour.

Sections 59 *and* 60.—Company to give notice on application to Justices for consent to level crossings of highways.

The Order deals specifically with each of these questions, and it is therefore necessary to exclude the operation of those Sections of the Railways Clauses Act. A vertical deviation from the levels as shewn on the deposited sections is allowed to any extent consistent with maintaining the requisite height of headway prescribed by the Railways Clauses Act and with maintaining rates of inclination on roads crossed by the railway not steeper than those so prescribed, but the promoters may not construct any embankment of a greater height above the surface of the ground on which it is constructed than 5 ft., or, with the approval of the Board of Trade, 10 ft. above the height shewn on the section.

The promoters may deviate laterally from the lines of the railway as indicated on the plan to the extent of the limits shewn, and with the consent of the owners and lessees of the lands on which any deviation is intended to be made to such extent beyond those limits as may be approved by the Board of Trade. The Order also allows the alteration of any curve shewn on the plan to nine chains' radius and any less radius that the Board of Trade may approve. Subject to the height of embankment referred to, the gradient of the railway may be altered to not steeper than 1 in 50.

There is no restriction in the Light Railways Acts in respect of the weight on rails, but in the model order 12 tons by any one pair of wheels is mentioned, with the proviso that if the rails used weigh not less than 64 lbs. per yard, the weight on the rails may be increased to 14 tons, and if the rails used weigh not less than 67 or 70 lbs., the weight on rails may be increased to 15 or 16 tons respectively.

In actual practice, in some cases no restriction is given in the Order, and in others from 12 to 16 tons is inserted. All depends, of course, upon the class and weight of rails used, and no doubt when promoters are drafting their Order consideration is given to the probable user of the railway when constructed and the weight on rails inserted accordingly. The necessity for the exclusion of the sections of the Railways Clauses Act referred to is therefore evident.

(6) There is no power of compulsory purchase by any local authority. The Acts of 1896 and 1912 transfer to the Board of Trade powers almost as extensive as proposed by Parliament itself, and the Orders will, therefore, vary somewhat according to the circumstances.

The Light Railways Act, 1896, came into operation on August 14th of that year, and it may here be said that up to the passing of this Act the only "facilities" for the construction of Light Railways were contained in the Regulation of Railways Act, 1868. This Act gave the Board of Trade power by licence to authorise the company to construct and work or to work as a light railway the whole or any part of a railway which the company has power to construct or work. This was to be subject to such conditions and regulations as the Board of Trade might from time to time impose.

(1) The regulations respecting the weight of locomotive engines, carriages and vehicles to be used on such railway had not to authorise a greater weight than eight tons to be brought upon the rails by any one pair of wheels.

(2) The regulations respecting the speed of trains was not to authorise a rate of speed exceeding at any time 25 miles an hour.

The Railways Construction Facilities Act, 1864, also gave certain powers for the making

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of branch and other lines of railways and deviations of existing railways without recourse to Parliament, if the consent of all the landowners, etc., interested could be obtained; but practically no light railways have been constructed under these Acts, owing, in a great measure, to the onerous conditions imposed by the Board of Trade for the public safety and to the difficulty of obtaining the consent of all the landowners.

Under the Act of 1896 a Commission, consisting of three Commissioners, is appointed by the President of the Board of Trade under the title of "Light Railway Commissioners." One of the present Commissioners is a civil engineer and the other two are barristers. An application for an Order to authorise a light railway must be made to these Commissioners.

Applications for Orders can be made by a county council, a town council, a district council, railway company, tramway company, any other company, companies or corporations, by any individual, or by any combination of these. But in the case of councils it is only where the proposed light railway is to pass through some part of their area that they can make or join in an application for an Order.

Parish councils cannot make or join in an application for an Order for the construction of a light railway, nor can they incur any expense in opposing or objecting to an application, except on the question of rating. Under certain circumstances, the Treasury is authorised to make special advances for the construction of light railways, and this has frequently been done.

Photo] [*Harrison & Sons.*

ANOTHER PICTURESQUE VIEW ON THE LEEK AND MANIFOLD LIGHT RAILWAY.

This line is worked by the North Staffordshire Railway.

The consideration by the Commissioners of applications are to be provisional only and will have no effect until confirmed by the Board of Trade; but when an Order is confirmed, it has all the binding force of an Act of Parliament. The Board of Trade are empowered to deal generally in the way of modification with the requirements for ensuring the safety of the public, and each separate application will be considered with

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respect to permanent way, gauge, fences, level crossings, bridges, gates, signals, station requirements, brake power, etc., and only such provisions as may be considered necessary in each particular case insisted upon, there being no limitation in the Act as to any of these requirements. No particular gauge is fixed by the Act, it being left to the Commissioners and the Board of Trade to deal with each scheme on its own merits, having regard to the requirements of each particular district.

The procedure which has to be adopted in making an application to the Commissioners for an Order for a light railway is governed by the Light Railway Acts and the Rules of the Board of Trade issued under these Acts.

The first step which the promoters should take is to consider carefully what sort of a light railway they really want and fix upon the route the line is to take; then consult the landowners and local authorities through whose land and areas it is proposed to run. When the scheme has been decided upon as a whole, the plans, together with the draft Order, must be prepared and afterwards submitted to the Commissioners.

The Commissioners have issued forms of a Model Order which as far as possible must be followed in all applications made to them. Applications may be made twice a year, in either May or November, and previous to the application a notice must be advertised in each of two consecutive weeks in the month of May or November in at least one local newspaper circulating in the area or part of the area through which it is proposed to make the railway, and once in the *London Gazette* during the month in which the notice is advertised.

(It may here be noted that an additional rule, dated September, 1914, was made by the Board of Trade, under which an application for an Order may be made "in any other month, with the consent of the Light Railway Commissioners." This is generally understood to be a special rule made to meet exceptional circumstances created by the War.)

The advertisement must contain :—

(1) A general description of the line of the railway and its termini and the lands it is proposed to take, the quantity of lands required, and the purpose for which they are taken.

(2) The proposed gauge and motive power of the railway.

(3) The address of the place where a plan of the proposed works and of the lands to be taken and a book of reference to the plan and a section of the proposed works will be deposited for inspection on or before the last day of the month in which the notice is advertised and also to name a place where copies of the draft Order can be obtained on or before the same day on payment of not exceeding one shilling per copy.

(4) A statement that in accordance with the rules objections should be made in writing to the Light Railway Commissioners and that a copy of the objections must be sent to the promoters.

The notice must be subscribed with the name of the person responsible for the publication of the notice.

Notices must also be served by the promoters in the month in which the notice of application is advertised in the form prescribed by the rules on every owner or reputed owner and lessee and the occupiers of all lands intended to be taken or being within the limits of deviation, describing in each case the particular lands intended to be taken and inquiring whether the person so served assents to, or dissents from, the taking of his land and requesting him to state any objections he may have to his land being taken.

A notice of an intended application must also be served by the promoters in the month in which the notice is advertised on the owners, or reputed owners, or lessee of any railway, tramway or canal which will be crossed or otherwise interfered with by the proposed railway. This notice must state the place or places where plans, etc., of the proposed railway have been or will be deposited. In the month in which the notice is advertised the promoters must deposit with the clerk of every county borough, district or parish council in or through whose county, borough, district, or parish any part of the railway is proposed to be made or which is otherwise affected, copies of the draft Order, the plan, section and book of reference, the estimate of expense of the proposed railway (including the expense of acquiring land and all preliminary and incidental expenses).

With these documents there must also be deposited the necessary sheet of the Ordnance Map on a scale of not less than one inch to a mile, with the line of railway and its mile points indicated thereon, so as

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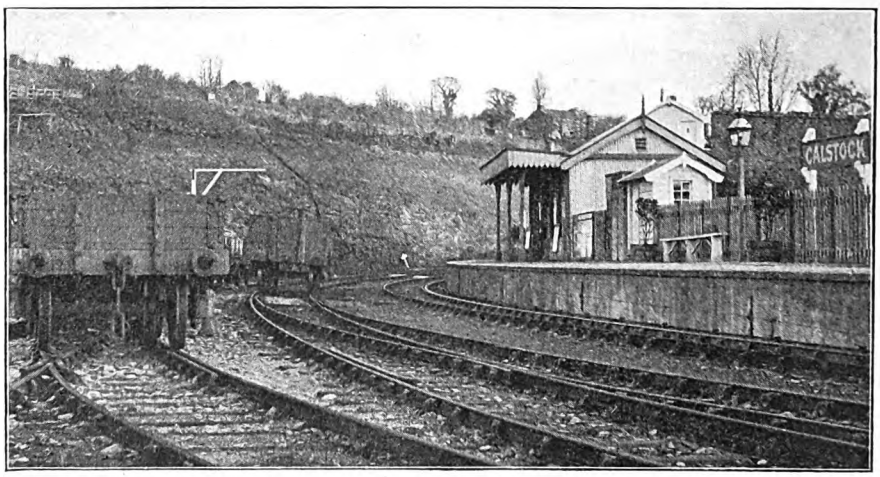
to show generally the course, length and direction of the railway. There are a large number of deposits necessary for the various Government Departments and in the case of the Board of Trade two copies of all the above mentioned documents must be made, one of which will be available for public inspection.

Where it is proposed to acquire or in any way affect "tidal" lands within the ordinary spring tides the Promoters are subject to similar conditions to those imposed in the case of an application for a Bill in Parliament, and similarly in the case of a bridge across tidal waters, it is necessary to give the dimensions as regards span and headway of the nearest bridge (if any) across the same tidal waters above and below the proposed bridge.

and the Board of Trade and in addition with the Clerk of every County, Borough, District and Parish Council in or through whose County, Borough, District or Parish any part of the railway is proposed to be made and it must be open to inspection during office hours.

The form used is given in the Board of Trade rules and must be deposited in the form given "or as near to as circumstances may permit." Applications for Orders authorising the construction of light railways must be lodged with the Commissioners in the month of May or November in each year (whichever month the notice is advertised in). Before lodging any application with the Commissioners a fee of £50 must be paid by the promoters to the Board of Trade, this being one of the Rules of the Board.



CALSTOCK STATION: PLYMOUTH, DEVONPORT AND SOUTH WESTERN JUNCTION RAILWAY.

If it is proposed to take for a light railway any land being part of any "Common" or any easement over any Common, the Promoters must send notice in writing during the month in which the notice is advertised to the Board of Agriculture describing the Common and the manner in which it is affected. Section 21 of the Act defines a Common to include any land subject to be inclosed under the Inclosure Acts, 1845 to 1882, any Metropolitan Common within the meaning of the Metropolitan Commons Acts, 1866 to 1878, and any town or village green.

An estimate of the expense of the proposed light railway must be deposited by the Promoters in the month in which the notice is advertised, with the Commissioners

The following documents must accompany each application :—

(1) Three copies of the draft Order, the plan, section, book of reference, the estimate and one inch ordnance maps shewing the line of railway with its mile points indicated thereon.

(2) A statement as to the proposed gauge and motive power of the railway.

(3) A list with their postal addresses of the owners, reputed owners, lessees or reputed lessees and occupiers on whom notices have been served and also a list of those on whom special notice has been served of any proposal to acquire part only of a house, building or manufactory.

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(4) A list of the County Borough, District and Parish Councils in or through any part of whose County Borough District or Parish any part of the railway is proposed to be made, and a statement whether or not they have intimated assent to or dissent from the proposal.

(5) A list of the railway, tramway or canal companies (if any) on whom any notice has been served under these rules and a statement whether or not they have intimated assent to or dissent from the proposal.

It will be noticed that it is not actually necessary to get the *consents* to an application.

(6) A statement whether any consent of the Board of Agriculture and Fisheries required to any grant of land, or to the acquisition of any Common land proposed to be authorised by the draft order has been obtained.

It may be observed that the consent of the Board of Agriculture and Fisheries is required under the Act of 1896 in any of the following cases :—

(*a*) Where any person has power to sell and convey any land for the purpose of any works of a light railway he may with the sanction of the Board of Agriculture convey the land for that purpose either without payment of any purchase money or compensation or at a price less than the real value and may so convey it free from all incumbrances. In other words this means that a tenant for life of an estate may convey the land of which he is tenant for life without payment of any purchase money or compensation or at a price less than the real value, with the consent of the Board of Agriculture. The reason for this sanction is that under the Settled Lands Act, 1882, a tenant for life is authorised to sell the settled land or any part of it, or any easement, right or privilege of any kind over or in relation to that land, the purchase money being paid to trustees for investment, and it would appear that such tenant might so deal with the land in which he has a life interest for the purposes of a light railway, but Section 4 of that Act says "any sale shall be made at the best price that can reasonably be obtained" so therefore if this restriction is to be departed from any sale on other terms must be with the sanction of the Board of Agriculture.

(*b*) Whenever any person who is a landowner within the meaning of the Improvement of Land Act, 1864, contributes any money for the purposes of any Works of a light railway the amount so contributed may with the sanction of the Board of Agriculture be charged on the land of the landowner improved by the works. In effect this means that the tenant for life of an estate can raise money on the security of the estate to subscribe to a light railway scheme which will benefit the estate.

(*c*) No land being part of a Common and no easement over or affecting any Common shall be purchased or acquired without the consent of the Board of Agriculture.

(7) A statement whether it is proposed that the Council of any County, Borough or District shall expend or advance any money and if so of the nature and amount of such expenditure or advance.

(8) A statement whether it is proposed to apply to the Treasury for the advance of any money and if so the amount of the advance sought.

The Treasury may make special advances either by a free grant or a loan, or partly a free grant and partly a loan, but before this is done the Board of Agriculture must certify to the Treasury that the making of such light railway under these Acts would benefit agriculture in the district proposed, or the Board of Trade must certify that by the making of such light railway a necessary means of communication would be established between a fishing harbour or fishing village and a market, or that such railway is necessary for the development of or maintenance of some definite industry, but that owing to the exceptional circumstances of the district the railway would not be constructed without special assistance from the State and the Treasury are satisfied that a railway company working railways open for traffic has entered into an undertaking, subject to an advance being made by the Treasury, to work the light railway.

The Treasury are not to make such advance unless they are satisfied that landowners, local authorities and other persons locally interested have by the free grant of land or otherwise given all reasonable assistance and facilities in their power for the construction of the railway.

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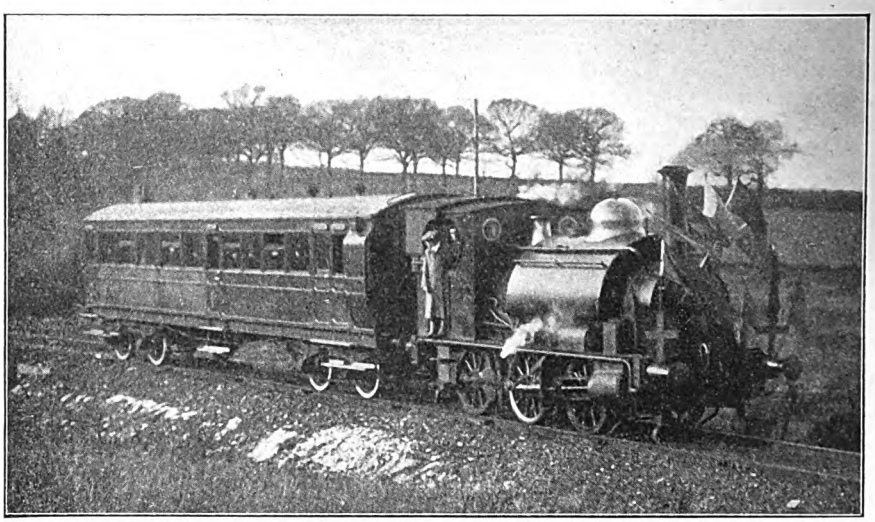
The advance is not in any case to exceed one half of the total amount required for the construction of the railway, as may be prescribed by Rules to be made by the Treasury. Where an advance is made as a free grant the Order may make provision as regards any parish, that during a period not exceeding ten years to be fixed by the Order, so much of the railway as is in that parish shall not be assessed to any local rate at a higher value than that at which the land occupied by the railway would have been assessed if it had remained in the condition in which it was immediately before it was acquired for the purpose of the railway. Before such provision is made in any Order the local and rating authorities of every parish concerned shall be informed of the intention to insert such provision and shall be entitled to be heard.

The total amount advanced by the Treasury under the Light Railways Acts is not to exceed one million pounds of which a sum not exceeding seven hundred and fifty thousand pounds may be expended for the purpose of special advances.

Under Part 1 of the Development and Road Improvement Funds Act, 1909, the Treasury may upon the recommendation of the Development Commissioners make advances through a Government Department *inter alia* to a public authority, or an association of persons or company not trading for profit by way of grant or by way of loan, or partly in one way and partly in the other for "the general improvement of rural transport (including the making of light railways but not including the construction or improvement of roads)."



TRAIN USED FOR THE OPENING OF THE EAST KENT RAILWAY.

(*To be continued.*)

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CONCOURSE AND BOOKSTALL: ABERDEEN JOINT STATION.

Reconstruction of the Joint Station at Aberdeen.

THE original station at Aberdeen goes back to the days of the Aberdeen Railway, afterwards included in the Scottish North Eastern, and from 1866 in the Caledonian Railway system, there being a small station fronting Guild Street, nearly on the site of the Joint station. At that time the Great North of Scotland Railway had an independent station at Waterloo, near the harbour, but about half-a-mile away, while the Deeside Railway ran into the Aberdeen Company's station. Although the Deeside Railway was not amalgamated with the Great North of Scotland until 1875, it had close associations therewith for many years before, and this fact probably facilitated the arrangement whereby a joint station was erected, and brought into use on November 4th, 1867, for the use of all three companies, the North British becoming a fourth "user," though not a joint owner, by virtue of running powers over the Caledonian Railway from Kinnaber Junction. The joint ownership of the station dates back to 1867, and with the absorption of the Deeside Company by the Great North of Scotland, the present dual ownership was created.

The station now superseded was in many respects an inconvenient one, though a large one according to views which would be current when it was built. The central portion had an all-over roof, but only one through platform line under it, necessitating a good deal of shunting and creating considerable difficulties when several important expresses from the south arrived close together, as often happened. There was, it is true, a through line, besides that alongside the platform, and outside the main station was a through "island"; but the former could not be of the same value as a platform line, and the latter was only suitable for local traffic—for which it was generally employed—or for the passage of goods trains. Otherwise the only platforms available were two

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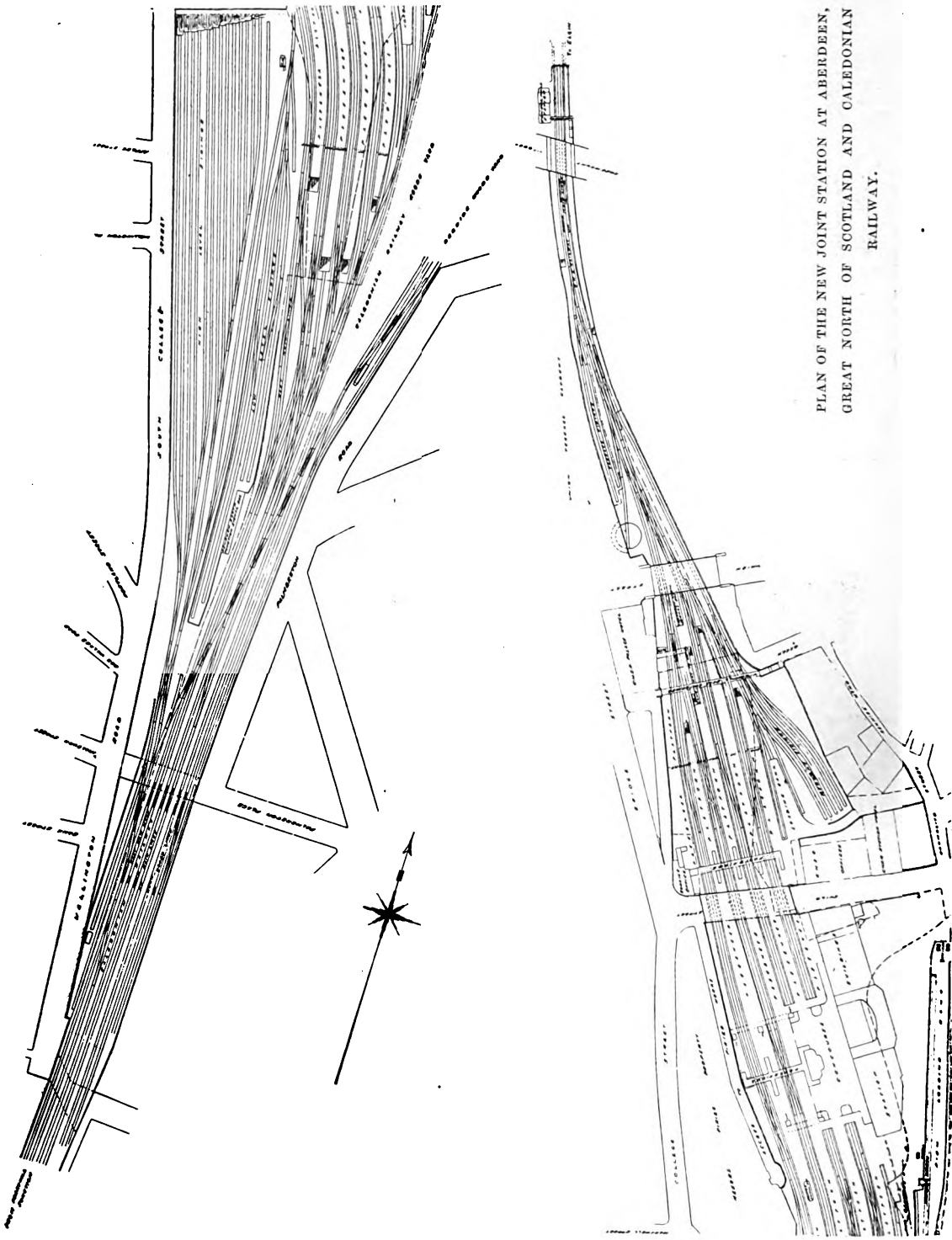

PLAN OF THE NEW JOINT STATION AT ABERDEEN, GREAT NORTH OF SCOTLAND AND CALEDONIAN RAILWAY.

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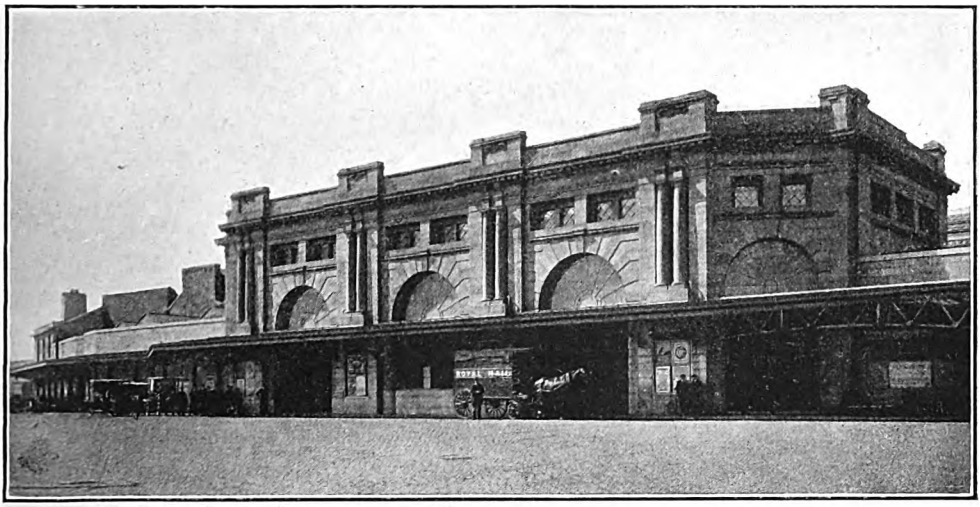
bays to the north—used by the Great North of Scotland northbound traffic—and three bay lines at the south end, from which Caledonian and North British trains usually departed if they could not be accommodated at the main platform, and where the Deeside line trains were dealt with.

Station appointments were, it is true, fairly modern, with refreshment and dining-rooms, enquiry offices, bookstall, etc., but for the volume of traffic, so much of it interchange between the companies concerned, it had long proved inadequate, so that the reconstruction became imperative.

It is now over two years since operations in connection with the erection of the new station at Aberdeen were commenced, and the work is now virtually completed. As reconstructed the joint station will rank as one of the largest in Scotland, and among the most handsome and elaborately fitted up structures of its kind in the British Islands.

By the courtesy of Mr. J. A. Parker, Chief Engineer, Great North of Scotland Railway, who is in charge of the work on behalf of the Joint Station Committee of the Great North of Scotland and Caledonian Railways, we are able to reproduce views of the new station, together with an interesting series of photographs.

Plans were prepared by Mr. Parker, as Engineer to the Joint Committee, and under his supervision the entire works have been carried out by the contractors, Messrs. P. and W. Anderson, Ltd., of Glasgow. The foundations of the new station were commenced on May 28th, 1913, and on September 7th of the same year the first operations in connection with the demolition of the old roof were begun. By the end of July, 1914, all the new platforms were in use, and about two-thirds of the main buildings were occupied. The masonry work was completed on August 31st, 1914, and the last remnant of the old station was removed in October. These operations had to be carried out without disturbing ordinary traffic. The platform lengths in the old station extended to 4,247 ft., whereas in the new station the total length is 11,340 ft., the largest platform, No. 6, being 1,596 ft. long.



EXTERIOR OF MAIN BOOKING HALL AND STATION BUILDINGS.

It has to be remembered that the station is designed for through traffic, though much of its traffic is terminal. Therefore, the main platforms have to be approached from the side. The station yard, reached from Guild Street, gives a view of the whole line of buildings, in the centre of which rises a block, of handsome architectural design, in which is situated the booking hall. Part of the masonry is in granite, but the bulk is in freestone. The spacious booking-hall is lit from the roof. From it pass two wide corridors leading to the central concourse, and from this large central area access is had direct to all the platforms, the five terminal or dock platforms for south trains, the five terminal platforms for north trains, and the main through platform.

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A footbridge and luggage lifts lead from the concourse to the island through platform, and beyond it to the western through platform, which is used for suburban traffic, and on which the suburban booking office is situated. Another footbridge, north of Guild Street, connects this booking office with all the platforms, and furnishes a more direct access from Bridge Street to the station than the main entrance.

On the east side of the station buildings is a large cabyard, and a wide foot pavement sheltered by an overhanging verandah. This pavement can be reached by steps descending from Guild Street under an arched portal, and it runs along the whole front of the building, giving access first to the Great North parcels office, then to the booking hall, and finally to the Caledonian and North British parcels offices.

Large doorways lead into the booking hall, where there is situated a handsome booking office, constructed of polished teak, containing 10 windows. A luggage weigh office is on the east side of the booking hall, and on the north side there is a very convenient and commodious office for receiving and giving out shop parcels. On the south wall there is an electric clock with a dial 5 ft. in diameter. All clocks in the station are electrically controlled from a master clock placed in one of the booking offices. Two corridors, each 21 ft. wide, give access from the booking hall to the platform concourse.

The main roof covering the concourse, a very fine structure of steel and glass, is 245 ft. long and 97 ft. wide. The actual platforms lie outside the concourse, and are covered with umbrella roofs.

In the centre of the concourse, facing travellers as they enter from the booking hall, there has been erected a handsome block of buildings, containing bookstall, station superintendent's office, telegraph office, and an overhead train information office. At the latter office large display boards, legible from the concourse beneath, are mounted, showing the platforms at which the various trains will depart and arrive, with the principal stations served. These train indicator boards are illuminated from behind at night.

INTERIOR OF BOOKING HALL.

At the north and south ends of the concourse are platform inquiry offices of the three railway companies. In the south-west corner is a tobacco stall, and in the north-west corner a large fruit and confectionery stall. On the west side of the concourse electric luggage lifts have been erected for

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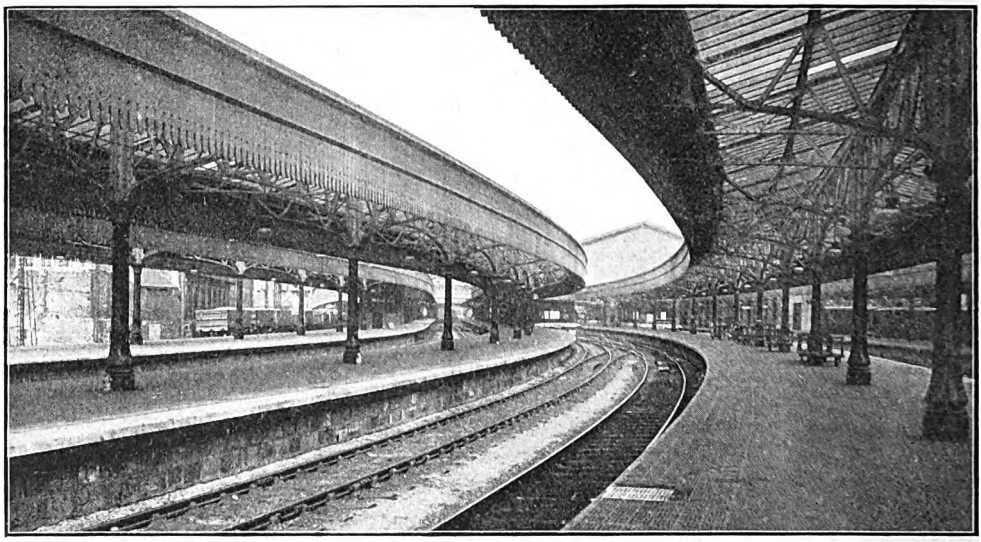
purpose having been laid to the platforms, where they can be connected with the train heating systems, for warming up while standing at the platform.

Lighting is entirely electric, and this power is also used to illuminate the various signals. The principal platforms are covered with Seyssel asphalte. The west platforms, on which there is less traffic, are paved with adamant slabs. The drains, water pipes, heating pipes, gas pipes, and electric mains are laid in conduits beneath the platforms.

In addition to the public offices, there are rest-rooms for the guards, porters, and other members of the railway and station staffs. A small hall has also been provided where the ambulance classes can be conducted or lectures given.

200 trains arrive and depart, but at busy periods this number is often increased by 40 to 50 per cent. All trains terminate, as far as the public is concerned, at Aberdeen, but some of the local Great North of Scotland trains between Aberdeen and Dyce, or *viâ* the Deeside line to and from Culter, operate for traffic purposes through the station from one section to the other. This local service is, by the way, an interesting one, though it has been reduced somewhat for minor stations since the extension of the Aberdeen tramways. Between Aberdeen and Dyce (6¼ miles), there are no fewer than nine intermediate stations, with at least an hourly service—more frequent at certain periods—in addition to which a number of main line trains call at the more



PLATFORMS AT SOUTH END.

As a joint station the work of the station is under the control of a joint superintendent, the present occupant of that position being Mr. R. A. Duguid. He has under his direction a staff of about 80 men, including platform foremen, shunters, signalmen, porters, clerks, etc. In addition, about 70 others are employed by one or other of the three railways concerned, on work affecting only their own particular company.

Mr. Duguid started his railway career away back in the 'sixties as a junior clerk with the old Scottish North Eastern Railway Company in 1865, so that he has been in Scottish railway service for the long period of 50 years.

In the course of twenty-four hours some

important of these stations. And between Aberdeen and Culter (7½ miles), there are eight intermediate stations, with a very similar service. It would be difficult to find another town of comparable character with local train services of this type.

Otherwise the traffic at Aberdeen is essentially main line. From the south the Caledonian Company operates a generous express service to and from Glasgow and Edinburgh, including the famous "Grampian" and "Granite City" corridor restaurant car trains, the Anglo-Scottish sleeping-car and restaurant car trains, the postal mail trains, and stopping main line and other trains to meet the needs of the district. The North British Railway operates

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only the East Coast and Edinburgh and Glasgow trains, with a few of more local interest, though there are none of the "stopping" variety, seeing that they run over Caledonian territory for 30 miles or so. The Deeside route of the Great North of Scotland Railway is, however, a busy and important one, and in combination the three companies operate a great deal of traffic into and out of the south end of Aberdeen Joint station.

Northwards are all the other routes of the Great North of Scotland Railway, to Cruden Bay and Boddam, Fraserburgh and Peterhead, Banff, Keith, Elgin (by two routes and thence onwards in conjunction with the Highland Railway to Inverness) Grantown and Boat of Garten and to Alford, these in the aggregate keeping the north end of the station busy.

Although there are no through trains, several through coaches are conveyed, and there is an extensive interchange of goods traffic, besides the frequent running of special fish trains and, especially since the outbreak of war, of military, troop, naval and stores trains.

Aberdeen Joint station is, in fact, the largest and busiest railway centre in the United Kingdom north of Edinburgh and Glasgow, and whatever may have been the case with the premises now superseded, the new station—fine erection as it is—is only what was required to meet the requirements and satisfy the importance of the "Granite City." That the two owning companies, and more particularly Mr. J. A. Parker, as their executive agent, have succeeded in raising upon the site of the famous and inadequate station which did duty until so recently, a structure which is artistically and operatively adequate, is a matter for sincere congratulation.

MR. R. A. DUGUID.
Station Superintendent.

In conclusion, we may mention that Mr. Parker, Chief Engineer, Great North of Scotland Railway, is a graduate of Glasgow University, and was apprenticed to Mr. John Strain, M.Inst.C.E., of that city, in 1885. From 1891 to 1896 he was engaged as Contractor's Engineer on the construction of suburban railways in Edinburgh and Glasgow. From 1897 to 1906 he was engaged on the widenings of the main line of the South Eastern Railway from Charing Cross to Chislehurst, first as Resident Engineer and, latterly, as Assistant-in-Charge of New Works, and in 1907 he was appointed Engineer to the Great North of Scotland Railway on the retirement of Mr. P. M. Barnett. Mr. Parker is a Member of the Institution of Civil Engineers.

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British Railway Officers in War Service [No. II.]

(*Continued from page* 172, *September number.*)

LAST month new statistics were given concerning men contributed from railway service and now serving with His Majesty's Forces—including, unfortunately, a by no means inconsiderable number who have given their lives "For King and Country." Additional information now to hand may be passed on to our readers, applying to railways whose record was not stated in the first article. Again we compare the new figures with those published in the *Railway Year Book*, dated for convenience as 1915.

LIEUT.-COL. A. D. LOMAS.
Assistant Land Agent, Lancashire and Yorkshire Railway.
Army Service Corps.

applying to February,

	Feb.	Sept.	+
Great Central	3,378	5,021	1,643
Hull and Barnsley ..	600	698	98
London, Brighton and South Coast.. ..	1,895	2,099	204

These three lines alone account for nearly 2,000 more men; but, in addition, the London and North Western and Lancashire and Yorkshire Railways send particulars which show important increases upon even the notable figures recorded concerning them last month. Then the London and North Western Railway claimed a total of 15,859 men. Now, barely a month later, and under date of August 27th, the total has increased to 16,231; while on a similar basis the Lancashire and Yorkshire claim 6,091, as against 5,926 as stated last month. In both instances the figures given in the first article were as recent as could be obtained before going to press, and yet important increases such as those noted can now be recorded. This goes to show how much our railways are doing in connection with the actual fighting forces, and it is doubtful whether such records can be excelled or even equalled in any other specific field of industry.

It may be explained, however, that in some instances the basis of enumeration has been changed, figures stated at earlier dates not always corresponding, some lines deducting men who had been killed, incapacitated, discharged on various grounds, or returned

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to railway or munition service, whereas others quoted all who had actually taken a place in the national forces. There is, however, greater uniformity in later figures, but as showing how large a difference deductions such as those noted may make, it may be mentioned that on the London and North Western alone, under date of August 20th, no fewer than 267 have been killed in action, drowned, or from other causes, while 113 have succumbed to wounds or died after illness, making a total of 380, and this is quite apart from records of missing (105); wounded, sick, etc. (1,414); and prisoners of war (170).

Resuming our survey of British railway officers now engaged in war service, the following particulars concerning railways not dealt with in this way last month will be of interest:

On the Great Western Railway there are no Chief Departmental Officers serving directly with His Majesty's Forces, though the Engineer and Railway Staff Corps includes Lieut.-Col. F. Potter (General Manager), Major C. Aldington (Supt. of the Line), and Major W. W. Grierson (Chief Engineer). There are, however, a large number of commissions held by members of the staff of various grades. In the Great Western Railway Company of Railway Troops, Royal Engineers, the following members of the engineer's staff have been granted commissions: Captain—Mr. R. C. G. Kirkpatrick, Chief Assistant to Divisional Engineer, Wolverhampton; Lieutenants—Mr. E. Lake, Second Assistant to Divisional Engineer, Plymouth; and Mr. A. S. Quartermaine, Assistant, Chief Engineer's Office, Paddington.

The following commissions, *inter alia*, may be noted: L. Auchterlonie, Vet. Surgeon, Lieut., Army Veterinary Corps.; H. W. Beckley, Surveyor, Lieut., R. E. (Special Railway Reserve Corps.); V. W. Beckley, Engineering Assistant, Lieut., R.E. (Special Railway Reserve Corps); S. B. Berry, Assistant, New Works, Lieut., R.E.; S. Burbridge, General Manager's Dept., Lieut Railway Troops, R.E.; T. Carus-Wilson, Assistant, New Works, Captain, 4th Batt. Duke of Cornwall's L.I.; S. S. Clark, Signal Inspector, Staff Captain, 6th Welsh Regt. (T.); T. G. Curnow, Supt. of Line's Dept., Lieut., Railway Transport; W. Holtum, Surveyor, Lieut., 1st City of London Royal Fusiliers; G. Jones, Assistant, Motor Car Dept., Slough, 2nd Lieut., A.S.C. (Motor Transport Section); R. C. Kirkpatrick, Chief Assistant, Engineering Dept., Wolverhampton, Captain, R.E., Railway Troops, 116th Co.; S. A. Meller, Engineering Assistant, Wolverhampton, 2nd Lieut., 13th Batt. Royal Fusiliers; A. S. Quartermaine, Engineering Assistant, Paddington, 2nd Lieut., R.E., Railway Troops, 116th Co.; H. T. Rendell, Motor Car Assistant, Slough, Captain, Motor Transport Section A.S.C.; S. H. Roberts, Assistant, Hotels and Refreshment Rooms, Lieut., A.S.C.; F. V. Simpkinson, Engineering Assistant, Wolverhampton, 2nd Lieut., R.E.; G. H. Spittle, Electrical Assistant, Paddington, Major, R.E. (Royal Naval Div.); H. Thomson, Surveyor, Newport, 2nd Lieut., 12th Service Batt. Scottish Rifles; R. H. Whitfield, Surveyor, Neath, 2nd Lieut., R.E.; C. S. Wilson, Assistant Manager, Locomotive Department, Swindon, Captain, Wilts Fortress Engineers (T.); and F. G. Wright, Assistant, Locomotive Dept., Swindon, Major and O.C., Wilts and Dorset R.E. Fortress (T.).

MAJOR G. J. BAUGH.

Marine Superintendent, Lancashire and Yorkshire and London and North Western Railways. joint services.

Royal Engineers, Inland Water Transport. On the staff at the War Office.

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Captain Kenneth J. Maples, of the Solicitor's Office, Paddington, who was killed by a fragment of shell, was a grandson of Mr. Frederick Maples of the firm of Young, Maples, Teesdale & Co., who acted as solicitors to the Great Western Railway before the appointment of Mr. Nelson.

On the Great Central Railway the General Manager, Sir Sam Fay, is a Lieut.-Col. in the Engineers and Railway Staff Corps, and the Chief Engineer, Mr. J. B. Ball, and Superintendent of the Line, Mr. W. Clow, are Majors in the same force. The following members of the Great Central Railway staff have obtained commissions with His Majesty's Forces: A. Blanden, Marylebone Station Superintendent; L. Napier, Assistant District Traffic Manager; E. C. Bates, an Assistant Solicitor; G. Powell, Solicitor's Office; H. S. Owen, an Assistant to the General Manager; H. B. Boothby, Outdoor Assistant to Portmaster; L. R. Christie, Assistant Excursion Manager; G. Leedam, Assistant Goods Agent; J. E. Pinion, General Manager's Office; S. H. Moore, Portmaster's Office; and G. S. Lynde, Loco. Inspector. Several steamship officers are serving, including Captains W. G. Wood, A. H. Chafer, and G. Unsworth, and Chief Officers C. V. Crossley and W. E. Senior. Several members of the Higher Grade Staff also hold commissions, including Messrs. C. G. Dandridge, W. H. Pryce, E. Rostern, S. E. Fay, and H. R. Statham. The District Electrical Engineer at Sheffield, Mr. W. H. Hunstone, is at present serving with the Royal Naval Division.

Lancashire and Yorkshire Railway officers are included in His Majesty's Forces or engaged in National War service in several important positions. We have already referred to Capt. H. E. O'Brien (Works Manager and Assistant Chief Mechanical Engineer), late in command of the 111th Company, Railway Troops, Royal Engineers, France, and now attached to the Ministry of Munitions. Other appointments include Major G. J. Baugh (Marine Superintendent, Lancashire and Yorkshire and London and North Western Railways joint services), attached to the Royal Engineers, Inland Water Transport Service, War Office; and Lieut.-Col. A. D. Lomas (Assistant Land Agent), Army Service Corps, at present stationed at Canterbury. We may also mention that Capt. E. C. Simpson, now acting as Chief Forwarding Officer in France, is a member of the staff of the Chief Goods Manager's Office. Capt. Simpson has been awarded the Military Cross in recognition of special services rendered in connection with railway transport in France. In addition to the foregoing there are numerous other officials now holding commissions in the Army, as practically all departments are represented in this respect.

The following members of the Lancashire and Yorkshire Railway staff engaged in war service and holding commissions may be mentioned: Harper, W. H. (General Manager's Chief Clerk), Capt., Railway Transport; Mitchell, A. C. O. (General Manager's), Lieut., South Wales Borderers; Macdona, C. L.

CAPT. E. C. SIMPSON, M.C.

Chief Goods Manager's Office, Lancashire and Yorkshire Railway.

Chief Forwarding Officer, France.

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Photo] [*Elliott & Fry.*

CAPT. C. L. CONACHER.

Late Traffic Manager, Cambrian Railways, now Staff-Captain, attached to the Ministry of Munitions.

(Superintendent's Department), Lieut., Railway Transport; Marriott, H., Assistant in Office of Superintendent of Line, Lieut., Railway Transport; Hamilton, H. (Superintendent's Department), Lieut., 13th Batt. Lancashire Fusiliers; Lees, H. M. (Chief Goods Manager's Outdoor Assistant,) Lieut., Railway Transport; Whitworth, H. (Chief Goods Manager's), Lieut., 5th Batt. Manchester; Barratt, W. M. (Audit Accountant's), Lieut., 9th Batt. Manchester; Armstrong, J., Solicitor, Lieut., 7th Batt. Cheshire; Daniel, H. E., Solicitor, Lieut., 4th Batt. Welsh; Hickson, W. O. (Solicitor's), Lieut., 5th Batt. Manchester; Sidebottom, J. K., Divisional Engineer, Lieut., Royal Engineers; Peck, J. N., Engineering Assistant, Capt., 1st Batt. City King's Liverpool; Rattray, R. C., Engineering Assistant, Lieut., Royal Engineers; Simpson, T. C., Engineering Assistant, Lieut., Royal Engineers; Eastwood, R., Engineering Assistant, Lieut., Royal Engineers; Jones, L. T. (Estate), Lieut., 5th Batt. Manchester; Hartshorn, A. H., Assistant to Western District Superintendent, Capt., Army Service Corps; Marsden, R., Assistant Manchester Ship Canal Office, (Lieut., killed in action in Dardanelles, June 7th, 1915), 8th Batt. Manchester; Roberts, H. E., Goods Agent, Bury, Lieut., Railway Transport; Carr, A. E., Superintendent Engineer, Formby, Capt., 3rd Batt. Lancashire Fusiliers; Chadwick, J. F., Pupil, Horwich, Lieut., Royal Engineers; Challoner, P., Premium Apprentice, Horwich, Lieut., 8th Batt. Welsh; Cooke, J. I. (Chief Mechanical Engineer's), Lieut., York and Lancaster; Fenton, R. N. C., Pupil, Horwich, Lieut., 4th Batt. East Lancashire; Ford, J. M., Premium Apprentice, Horwich, Lieut., 8th Batt. L. North Lancashire; Gooch, G. F., Pupil, Horwich, Lieut., Royal Garrison Artillery; Hewetson, R. P., Assistant Locomotive Foreman, Fleetwood, Lieut., R.F.A., 6th Reserve Brigade; Howard, C. P., Pupil, Horwich, Lieut., County Palatine R.F.A.; Jones, D. S. H., Pupil, Horwich, Lieut., Public Schools 3rd Batt. A. Company; Palmer, S. L., Premium Apprentice, Horwich, Lieut., South Wales Borderers; Pedder, R. S., Pupil, Horwich, Lieut., Lancashire Fusiliers; Sangster, W. M. (Chief Mechanical Engineer's), Lieut., 4th Batt. Loyal North Lancashire; Sloan, D. T., Automobile Expert, Lieut., R.G.A. (Siege Train Section); Whalley, W. C., Premium Apprentice, Horwich, Lieut., 5th Batt. Loyal North Lancashire; Dearden, W., Premium Apprentice, Horwich, Lieut., 11th Service Batt. N.S. Regiment.

From the T.O.T. combination, covering the Metropolitan District, London Electric, Central London, and City and South London Railways, the London General Omnibus Company, Ltd., and the tramways in association, several interesting appointments may be noted. Mr. Arthur Churchill, Purchasing Agent, is Lieut.-Col., 24th County of London Regt. Mr. Ivor Fraser,

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Advertising Manager, holds the rank of Lieut.-Commander, and as Lieut., Hawke Battalion, Royal Naval Division, he took part in the Antwerp Expedition; subsequently he was promoted Lieut.-Commander, Royal Naval Air Service, Armoured Car, in charge of Squadron No. 8. Mr. C. E. Fishbourne, Traffic Assistant to Commercial Manager, holds the rank of Captain. As a Lieut., Royal Engineers, he was called up to join the 9th Field Troop, R.E., and attached to the 4th Division. He took part in the retreat from Mons to the Sambre, and in the subsequent advance to the Aisne; thence he was transferred to Armentières. Wounded by shrapnel in December, near La Bassee, he was mentioned in despatches; and subsequently promoted Captain and made Adjutant to a new battalion at Chatham. Captain Fishbourne died on June 10th, of illness contracted at Chatham. Mr. Herbert E. Ellis, Assistant to Advertising Manager, is Lieut., Royal Naval Reserve, and Inspector of Steel. Mr. C. Page, Legal Assistant to Commercial Manager, now promoted to Captain, joined as 2nd Lieut., 7th Border Regt. Mr. A. Rozier, Superintendent of Training, London General Omnibus Co., Ltd., Captain, Army Service Corps, is in charge of the War Office Training Depôt for Motor Drivers at Hounslow.

CAPT. H. E. O'BRIEN.

Assistant Chief Mechanical Engineer, Lancashire and Yorkshire Railway.

Late in command of the 111th Company. Railway Troops, Royal Engineers, and now attached to the Ministry of Munitions.

On the Hull and Barnsley Railway, the Chairman of the Company, Mr. Charles W. Trotter, is Colonel, South Notts. Hussars, at present stationed at Narford, Norfolk. The following officers also hold commissions: Dr. F. B. Moss Blundell, Assistant Solicitor, Lieut.-Col., 2nd Northumbrian Brigade, Royal Field Artillery (Territorial), at present serving in France; Mr. F. L. Pawley, Assistant Dock Engineer, Capt., East Riding Royal Garrison Artillery (Territorial), Humber Defences; Mr. F. Wilson, Locomotive Department, Springhead, Hull, Lieut. and Quartermaster, Royal Army Medical Corps, serving with the Home Hospital Reserve; Mr. J. Andrew, Clerk, Audit Office, 2nd Lieut., 3rd Batt. King's Own Yorkshire Light Infantry.

On the Great Eastern Railway the only departmental officer calling for mention in this connection is that of Lieut. E. Wilson, District Engineer, Ipswich.

Mr. T. W. Pearson, Locomotive Supt., Alexandra (Newport and South Wales) Railways and Docks, holds the rank of Major.

On the London, Brighton and South Coast Railway there is only one chief officer on military service, namely, Mr. Vivian Rose, Solicitor. He is a Staff Captain in the Oxford and Bucks Light Infantry. A few other departmental chiefs may, however, be noted: Captain Hutchence (Season Ticket Department), 1st Surrey Rifles; Captain Trotter (Engineer's Assistants), King's Liverpool (Pioneers); Lieut. Glynn (Engineer's Assistant), 109th Company, Royal Engineers.

As the record of commissioned officers supplied by the London, Brighton and South Coast Railway includes a number of gentlemen well-known in the service, the following list will be of interest: P. V. Rose, Solicitor, Staff Capt., Oxford and Bucks Light Infantry; A. Hutchence, Clerk, Office of Superintendent of the Line, Capt., 1st Surrey Rifles; A. F. Trotter, Engineer's Assistant, Capt., King's Liverpool (Pioneers); G. G. Glyn, Engineer's Assistant, Lieut., Royal Engineers (died as result of motor cycle accident); H. H. Ross, Clerk, Goods Superintendent's Office, Brighton, Lieut., Royal Army Medical Corps; C. Summerscales, Fitter's Apprentice, Locomotive Department, Lieut., 3rd Connaught Rangers;

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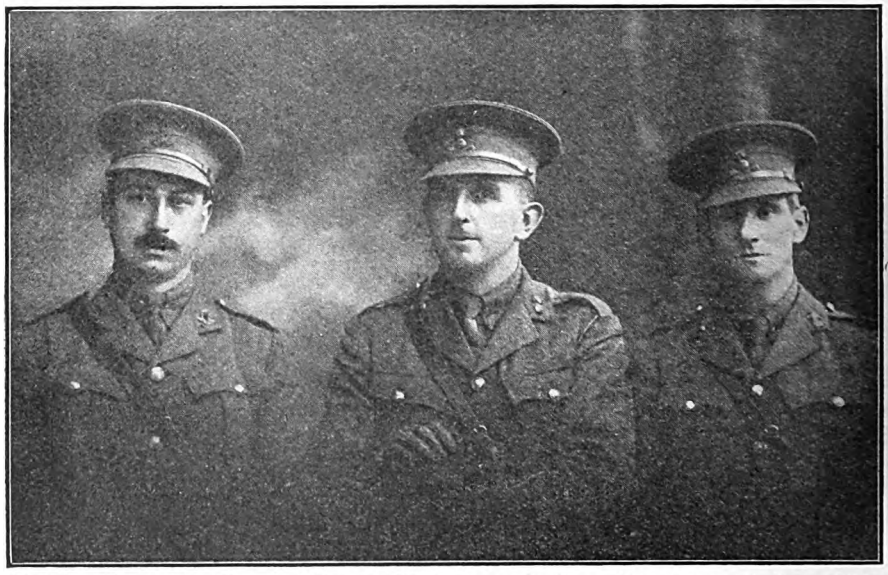
C. C. Brill, Clerk, General Manager's Office, 2nd Lieut., 8th East Surrey Regiment; E. Cockburn, Fitter's Apprentice, Locomotive Department, 2nd Lieut., 9th East Lancashire Regiment; A. E. Prosser, Clerk, Continental Department, 2nd Lieut., 2nd Worcester Regiment; C. Bamber, Fitter's Apprentice, Locomotive Department, 2nd Lieut., 14th Royal Fusiliers; Philip H. Jackson, Engineer's Assistant, 2nd Lieut., Royal Engineers.

In the case of the London and South Western Railway the Chairman, Mr. H. W. Drummond, is rendering important services, as to which we hope to refer further in due course, while Sir Herbert Walker, General Manager, holds the rank of Lieut.-Col., Engineer and Railway Staff Corps, besides being Acting Chairman, Railway Executive Committee. It will be remembered that Mr. Gilbert Szlumper, assistant to the General Manager, is acting as Secretary to the Railway Executive Committee. Mr. M. F. Ryan, Assistant Locomotive Engineer, now attached to the department of the Ministry of Munitions, has already been mentioned. In addition, Captain D. Maxwell, of the Marine Department, is a Captain in the Inland Transport Section, Royal Engineers.

Other appointments held by members of the London and South Western Railway staff may be noted as follows:—*Accountant's Department.*—Mr. E. J. Soper, Lieut., Army Ordnance Corps; Mr. T. W. Collins, Lieut., Middlesex Regiment. *Docks and Marine Department.*—Mr. G. G. Poole, Lieut., R.F.A.; Messrs. Hamilton, Hodges, Carroll, Oxlade and Payne, Lieuts., Royal Navy. *Locomotive Department.*—Mr. T. B. Lyle, Major, A.S.C. Mechanical Transport; Mr. S. T. Carter, Capt., Hants Fortress (R.E.); Mr. R. Godley, 2nd Lieut., Royal Garrison Artillery; Mr. Q. S. Irvine, 2nd Lieut., Argyll and Sutherland Highlanders; Mr. A. H. Fynn, Lieut., Staffordshire Regiment; Mr. J. W. Edwards, Lieut., Royal Naval Division (since died of wounds received at the Dardanelles. Son of the Company's Horse Superintendent, Nine Elms). *Goods Manager's Department.*—Mr. J. E. Griss, 2nd Lieut., Army Service Corps. *Solicitor's Department.*—Mr. H. F. Burt, Lieut., Royal Field Artillery. *Superintendent of the Line's Department.*—Mr. A. E. Colley, Capt., East Kent Regiment. *Treasurer's Department.*—Mr. W. Colley, Capt., Musketry Instructor, Royal Welsh Fusiliers. *Engineer's Department.*—Mr. R. W. Hartridge, Capt., Royal Engineers.



2ND LIEUT. J. P. PIKE. Royal Irish Fusiliers. Late Midland Great Western Railway Clerical Staff.

2ND LIEUT. G. T. HAMLET. Royal Dublin Fusiliers. Assistant Cashier.

2ND LIEUT. E. N. POWELL. Royal Dublin Fusiliers. Traffic Manager's Office.

Some commissioned officers from the Midland Great Western Railway of Ireland.

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The undermentioned well-known members of the staff are also serving with the colours as "rankers." Mr. W. C. Moore, Chief Draughtsman, Electrical Engineer's Department; Mr. J. Parker, Chief Clerk, Rating Office; Mr. H. L. Sinedley, Solicitor's Department.

The only Caledonian Railway Chief Officer who is serving with the Colours is the Outdoor Assistant Superintendent of the Line—Lieutenant M. S. Speir—who is acting as a Railway Staff Officer in France. Mr. Speir was transferred from the Midland Railway to the Caledonian Railway in February, 1911, as Assistant Outdoor Mineral Superintendent, and in July, 1912, he was appointed Outdoor Assistant Superintendent of the Line. On September 26th, 1914, he was granted permission to enlist in His Majesty's Forces.

On the Midland Great Western Railway of Ireland, Mr. Wm. Richardson, the Secretary's Chief Clerk, has been appointed Lieutenant in the Royal Irish Rifles; Mr. Geo. T. Hamlet, Assistant Cashier, has been appointed 2nd Lieut. in the Royal Dublin Fusiliers, as has also Mr. Ernest Powell, of the Traffic Manager's Office. Mr. Maurice V. P. O'Byrne, Assistant Staff Clerk, General Manager's Office, has been appointed Assistant Naval Paymaster. In addition, a former member of this company's clerical staff, Mr. Jos. Pike, has also obtained a commission, and Mr. Rupert Jones, son of Mr. F. E. Jones, Chief Clerk to the Irish Traffic Manager of the London and North Western Railway Company, who was also in the Midland Great Western Railway service, has joined the Colours, as has Mr. Jos. Wilcox, son of the Chief Clerk to the Engineer-in-Chief. Mr. Pike and Mr. Jones returned from Buenos Aires, where they had been engaged on railways for some years, to assist the Empire in the War.

Photo] [Lafayette, Ltd.

2ND LIEUT. W. RICHARDSON.

Royal Irish Rifles; Secretary's Chief Clerk, Midland Great Western Railway of Ireland.

MR. M. V. O'BYRNE.

Assistant Paymaster, R.N.; Assistant Staff Clerk, General Manager's Office, Midland Great Western Railway of Ireland.

A few other items affecting railway officers engaged in war service, may be noted. Among recent appointments gazetted have been:—

Territorial Force, Royal Engineers, Western Sig. Cos. (Army Troops):—Lieut.-Col. Sir R. Turnbull, Kt., M.V.O., Engineer and Railway Staff Corps, to be Hon. Colonel (August 7th).

Assistant Directors of Railway Transport. Following is graded for purposes of pay as Assistant Quartermaster - General from

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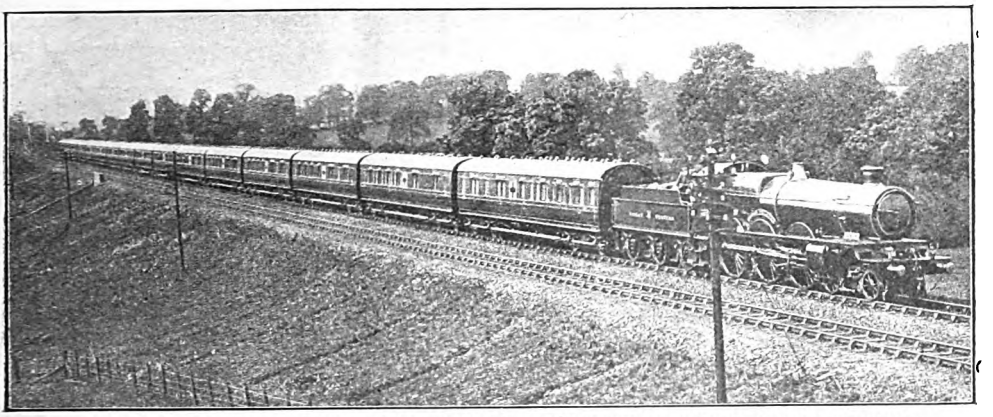

GENERAL VIEW OF GREAT WESTERN RAILWAY HOSPITAL TRAIN FOR SERVICE IN FRANCE.

Ambulance Trains for Service on the Continent. [No. II.]

(*Continued from page* 180, *September number*).

A BOOKLET entitled "Hospital Trains: How they are saving Soldiers' Lives" has been issued by the "British Red Cross Society and the Order of St. John of Jerusalem in England." Copies can be had on application to the Headquarters Collections Committee (Room 99), 83, Pall Mall, London, S.W., but some reference to its contents will be in order.

Naturally it is concerned mainly with trains equipped by or in conjunction with Red Cross agencies, as distinct from those trains which have been prepared on the instructions of the War Office and the Admiralty, and this fact must be borne in mind. In introduction it is pointed out that it was not until the Boer War that this country really appreciated the necessity for Hospital Trains and realised their value. While France, Russia, Italy, and other countries already possessed Red Cross trains, we had naturally concerned ourselves more with Red Cross ships. It is interesting to recall that in that war, as in this, the necessary funds for the first *Red Cross* Hospital Train were raised largely through the energy of H.R.H. Princess Christian.

The experience in construction gained fifteen years ago has been turned to good account to-day. Whereas, however, the old train was about 250 ft. long and accommodated 74 patients, its modern successor has a total length of 700 ft.—nearly one-seventh of a mile—and can accommodate as many as 450 patients. This splendid train was constructed by the Birmingham Railway Carriage Company, under the personal direction of Sir John Furley, with the practical assistance of Mr. William J. Fieldhouse. It was described in the RAILWAY MAGAZINE for May, 1915. The task with which designers and builders found themselves confronted was not an easy one in any case, nor were the difficulties diminished by the necessity for consulting different bodies on both sides of the Channel. While the French railway engineers asked that all couplings, brakes, and lighting arrangements should be submitted for their approval, the British War Office asked that four more coaches, each to carry 50 sitting-up patients, should be added to the eight originally contemplated. In addition, the French regulations required that an ordinary brake-van should be attached to each end of the train. This brought up the number of coaches to 14.

In order to co-ordinate requirements, a Joint Committee was therefore formed, comprising the French railway engineers and also the managers of the leading English railway companies. Admittedly it had the great advantage of being designed and constructed from first to last solely in view of the purpose to which it was to be put.

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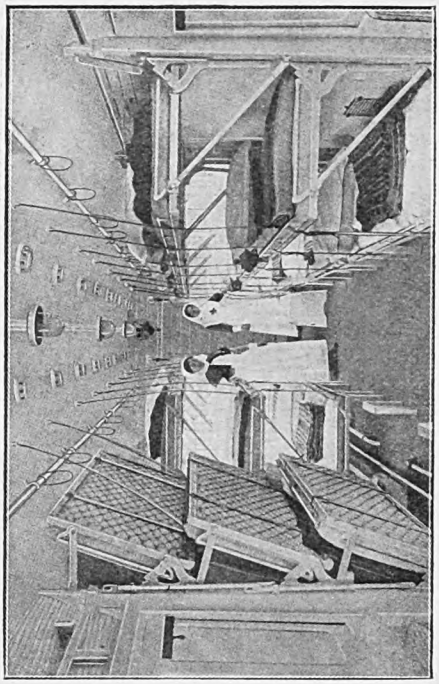
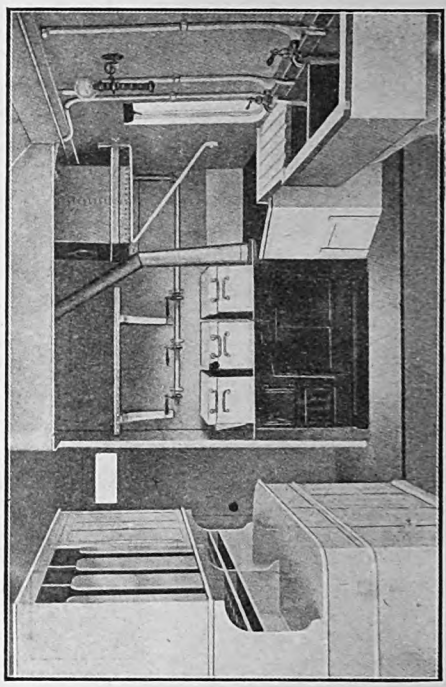
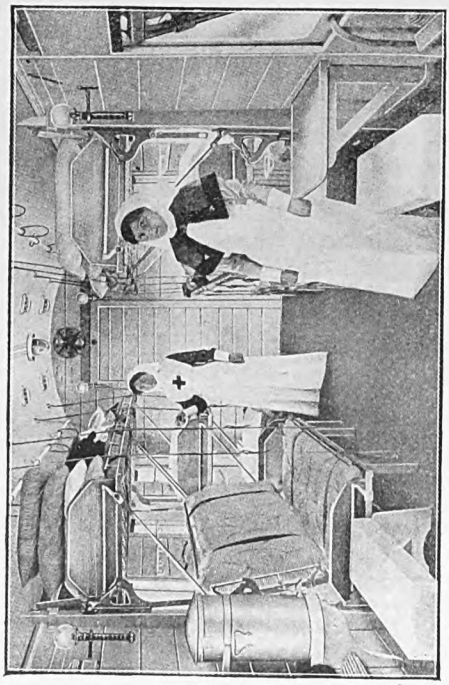


INTERIOR OF WARD CAR, SHOWING SOME OF THE COTS FOLDED UP.



INTERIOR OF KITCHEN.



WARD CAR, SHOWING TWO BEDS CONVERTED INTO COUCH.

TREATMENT ROOM.

Views in Ambulance Train equipped by the Great Western Railway for service in France.

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As already indicated, the trains which have been equipped under "Red Cross" auspices must be considered on their own basis. There are, in fact, five different classes of ambulance equipment, apart from variations, to be taken into account, and they may be approximately classified thus: (1) the trains originally equipped in France; (2) the British trains for use on the home railways; (3) Red Cross and kindred trains built here by private generosity or on the basis of funds supplied by the public; (4) ambulance trains for service in France built here on the instructions of the Government; and (5) miscellaneous vehicles, such as the Glasgow and South Western-built ambulance vans, and the North Eastern-built "rest" vans.

The first class covers a wide range, from hurriedly equipped trains prepared in France to at least one train made up of vehicles taken from English trains, and replaced for home use. Quoting again from the booklet referred to it is stated that the first of the Societies' Hospital Trains to start its beneficent operations was the one known as "Number XI. Ambulance Train." This was made up of third-class carriages belonging to a French railway company, equipped with fittings sent over from England and arranged on the spot at emergency speed. The train was very much handicapped by the circumstance that there was no through communication from coach to coach, and it was not possible to make one. Consequently, its management had to be left to the goodwill and ability of the staff. Each carriage was as far as possible self-contained—if there were very serious cases in certain carriages, the staff had to be increased in that particular vehicle. Yet, notwithstanding every difficulty and contrary to all predictions, the train has proved a very great success, for which signal credit is due to commandant and staff.

As regards the trains equipped for service on the home railways, these received attention in these pages during the later months of 1914, as also the ambulance vans—one of these, provided by the Glasgow and South Western Railway, was described last month—and the "rest vans" prepared by the North Eastern Railway. But the third and fourth trains require differentiation. In the former class are the trains presented on the basis of private generosity or public subscription—the more recent "Red Cross" trains proper. These include the "Princess Christian" train, the "Queen Mary" or "Lord Michelham" train and the two British sections presented by the United Kingdom Flour Millers' Association. These four trains were described last May.

Then come the eight trains which are now receiving attention, and which are being utilised also for public exhibition for the benefit of benevolent and charitable funds. Last month the trains equipped by the London and North Western, Lancashire and Yorkshire, and Great Eastern Railways, for service in France, were described.

These trains are all designed on substantially the same lines, each consisting of 16 bogie vehicles equipped to give the same accommodation. Two were supplied by the London and North Western Railway, two by the Great Western Railway, one by the Lancashire and Yorkshire Railway, one by the Great Eastern Railway, one by the Caledonian Railway, and one by the London, Brighton, and South Coast Railway.

On Wednesday, Thursday, and Friday, August 25th, 26th and 27th, the Great Western Railway exhibited one of the two ambulance trains equipped at Swindon for service on the Continent. The train was placed at platform A, the recently constructed extension of No. 1 main line departure platform. As this platform is generally utilised for excursion, milk and other special traffic, and has, besides, a separate entrance away from the main station, this location was particularly suitable for exhibiting the train, its length being sufficient to take the complete set of 16 vehicles.

A charge of 1s. for each person was made, the money collected, including that realised by the sale of packets of postcards illustrating the train and some of its vehicles, and by collecting boxes, being given to War Funds for the benefit of the wounded and for railwaymen serving in His Majesty's forces.

There was not the crowded attendance which some other exhibitions have realised, but throughout the period during which the train was on view—11 a.m to 7 p.m. each day—there was a steady stream of visitors passing through. Several men from the Slough Division of the St. John Ambulance Association, together with a number of voluntary nurses from the same organisation, were in attendance along the train describing and exhibiting the various appliances available.

In general design the train corresponds with those equipped by the Lancashire and

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Yorkshire, London and North Western, and Great Eastern Companies, which have been already described, this being in accordance with instructions from the Sub-Committee appointed by the Railway Executive Committee for dealing with these trains. As, however, existing vehicles are utilised, there are necessarily certain variations, seeing that dimensions of vehicles differ somewhat, even for coaches of corresponding design, on different railways. In this case the large size of modern Great Western rolling stock has given slightly greater latitude in certain directions. This is particularly noticeable in the "personnel car," the doctors' dining saloon being quite a roomy compartment, with oval table placed longitudinally instead of transversely. The train is 960 ft, long and weighs 442 tons, the accommodation being the same as in other trains.

The Caledonian train has been exhibited during September in accordance with the following programme :—

GLASGOW (CENTRAL) (Platform No. 1).—Thursday, September 2nd, 3 p.m. till 10 p.m.; Friday, September 3rd, 8 a.m. till 10 p.m.; Saturday, September 4th, 8 a.m. till 10 p.m.

EDINBURGH (PRINCES STREET) (Platform No. 1).—Monday, September 6th, 3 p.m. till 10 p.m.; Tuesday, September 7th, 8 a.m. till 10 p.m.; Wednesday, September 8th, 8 a.m. till 10 p.m.

DUNDEE (WEST) (Platform No. 4).—Friday, September 10th, 3 p.m. till 10 p.m.; Saturday, September 11th, 8 a.m. till 10 p.m.

ABERDEEN.—Monday, September 13th, 3 p.m. till 10 p.m.; Tuesday, September 14th, 8 a.m. till 10 p.m.

STIRLING (East Platform).—Wednesday, September 15th, 3 p.m. till 10 p.m.; Thursday, September 16th, 8 a.m. till 10 p.m.

PERTH (GENERAL) (Crieff Branch Dock).—Friday, September 17th, 3 p.m. till 10 p.m.; Saturday, September 18th, 8 a.m. till 10 p.m.

GREENOCK (CENTRAL) (Up Dock).—Monday, September 20th, 3 p.m. till 10 p.m.; Tuesday, September 21st, 8 a.m. till 9 p.m.

A charge of 1s. was made for each person inspecting the vehicles, the money collected going to the funds of the Scottish Branch of the Red Cross Society.

The Duchess of Montrose formally opened the Exhibition at Glasgow Central station on Thursday, September 2nd. Her Grace was introduced by Sir Charles Bine Renshaw, Chairman of the Company. Among those present were the Marchioness of Bute, Lord and Lady Newlands, Lady Stirling Maxwell, Sir Charles and Lady Bine Renshaw, Lady Patten MacDougall, the Lord Provost and Mrs. Dunlop, Sir George T. Beatson, Lieut.-Col. R. D. M'Ewan.

The station was gaily decked with bunting, and it was early evident that Glasgow citizens were deeply interested in the train, and long before 3 p.m. hundreds of people had collected in the station. By the opening hour there must have been fully 2,000 who had provided themselves with tickets of admission, and this number was augmented continuously during the remainder of the afternoon. Just before the formal opening ceremony a draft of the 3/2nd Lowland Field Ambulance was inspected by the Duchess of Montrose.

This train has been equipped at the St. Rollox Works in Glasgow, under the supervision of the locomotive superintendent, Mr. William Pickersgill. It is made up of sixteen corridor carriages connected together by flexible gangways, and arranged in the following order :—

1 brake and stores car (in front).
1 kitchen and stores car.
4 wards for lying-down patients.
1 pharmacy car.
1 staff car.
5 wards for sitting-up patients.
1 kitchen and mess-room.
1 personnel car.
1 infectious ward and brake car (in rear).

The front car contains the guard's brake, and living compartments, while the remainder of the space is set apart for comestibles and other stores. The two kitchen cars have each the usual culinary equipment, including an army service coke cooking and heating range, sinks, dressers, cupboards, tables, hot and cold water tanks, etc., also a cooks' living room, with three folding cots. In the front kitchen car there is a stewards' store, and a soldiers' pack apartment, and the corresponding space in the other car is used as a mess-room, with folding tables, and as a store for officers' kits. The walls of the kitchen proper are partially zinc lined, and the floor is lead-covered. An electrical fan helps to keep the cooking apartment cool.

The four ward cars for lying-down patients each accommodate thirty-six men in the cots, which are fixed lengthwise in three

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tiers at either side, and can be folded against the sides of car to facilitate cleaning or to permit of the lowest berths being used as seats. Stools are provided for reaching the higher cots. To facilitate loading, these cars are provided on both sides with double width doors for the easy admission of stretchers, and when considered desirable a patient may be deposited in a cot without withdrawing the stretcher. A constant current of fresh air is ensured by means of both fixed and portable electrical fans, the latter being available when required for playing direct on the faces of fevered or "gassed" patients.

Three of the five ward cars for sitting-up patients are constructed with saloon compartments, while two have side corridors and ordinary compartments, and afford seating accommodation for 292 patients. Four of the cars are upholstered in hygienic blue leather cloth, the remaining one having three-ply sycamore seats and backs, with the view of minimising the risk of infection in the case of doubtful cases. Fixed and portable electrical fans are also part of the equipment of these cars, which have a small pantry.

The pharmacy car has ample accommodation for dispensary commodities, and all necessary medicinal, surgical, and nursing appliances, including a water heater and a steriliser, as well as a treatment compartment with operating table. There is also an office for the doctors, containing a table, a chair and a safe, and several storage compartments for bandages, linen, splints, etc. The walls of the treatment compartment—as in the case of the kitchens—are partially zinc-lined, and the floor is lead-covered. For the convenient handling of patients requiring special attention on the journey the corridor of this car has been made of sufficient width to readily admit a stretcher without discomfort to the patients. The treatment room is provided with a large sliding door.

The staff car gives accommodation for the medical officers and nurses. It has three state rooms for the officers, each containing a bed, a seat, and a folding table; and two state-rooms for the nurses, in each of which are two folding beds, a seat, and a folding table. At either end of the car are the mess-rooms for the doctors and the nurses, and in the doctors' mess-room there is an emergency folding bed.

The personnel car consists of seven compartments with side corridor from end to end, and is for the use of twenty-eight orderlies. Each compartment has two beds—one placed directly above the other on either side—the top berth, when folded down during the day, forming a back to the lower one which is used as a seat. There are two shelves in each compartment for the use of the inmates. The rear car is the infectious ward, having two separate compartments with eighteen folding cots, and adjoining, but completely isolated from the infectious ward, is the guard's brake and living compartments.

Throughout the train abundant sanitary and lavatory conveniences are provided, including drinking water, which, in the case of the ward cars, is contained in padlocked tanks, so that its use may be controlled. The total water tank capacity available for all purposes on the train amounts to 1,600 gallons.

Ventilation of the cars is effected by the usual roof air extractors, in addition to the electrical fans already referred to. They are also steam-heated, and in addition there is a self-contained coke furnace installation in the staff and personnel cars. The lighting is by electricity generated by dynamo driven off one of the axles of each car, and in addition to this there are special candle brackets fitted throughout the train for use in cases of emergency. Floors are covered with thick inlaid linoleum.

The interiors of the vehicles generally are done up in white enamel, and the exteriors are painted khaki colour with a prominent Red Cross in the centre of each coach. Each car bears the train number on its sides and ends, together with a distinctive letter for identification. To ensure smooth and comfortable running, the springs are of the most approved description, and all the cars are carried on four-wheeled bogies. The brake installation is of the Westinghouse automatic air type, and all the coupling appliances are suitable for attachment to French locomotives. The train is 300 yds. in length, 442 tons in weight, and provides accommodation for 454 patients and forty-four officials, being a total of 489 persons.

Referring again to the "Red Cross" booklet it is there explained how these trains are staffed. The Officer Commanding usually bears the rank of Major of the Royal Army Medical Corps. He is responsible for the train and for all and everything on board, also for the loading and unloading of the train, the comfort of the wounded, and the control of the personnel in its

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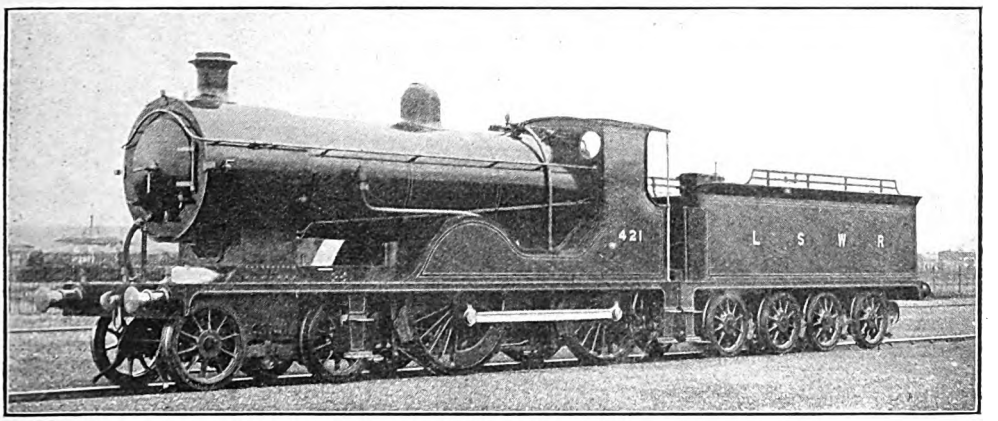
multifarious duties. The Medical staff usually makes three, one of whom is appointed Chief Medical Officer. Each officer is responsible for the particular wards allotted to his care. The nursing staff comprises a Matron and a sufficient number of nurses or "sisters," who may be placed in charge of one or more wards to assist the Medical Staff. Finally, there are the N.C.O.'s and Orderlies, the Cooks, the Dispenser and Storekeeper, and a Clerk.

It may be mentioned that the Joint Committee of the British Red Cross Society and the Order of St. John of Jerusalem is in close touch with the requirements of the War, wherever waged. It is working in harmony with the Military Authorities, and is only anxious to supplement the magnificent work done by the Royal Army Medical Corps. Everyone may feel that his money will go to the sick and wounded with a minimum of deduction for expenses. The administrative staff, which is large, is also mainly voluntary both in England and at Boulogne (the headquarters of the Committee in France), Malta, and Alexandria, and every possible precaution has been taken to secure the most economical administration of the funds entrusted to them by the public.

ANOTHER INTERESTING LOCOMOTIVE REBUILD: LONDON AND SOUTH WESTERN RAILWAY.



HAVING superheated some of Mr. Dugald Drummond's last class of 4-4-0 locomotives, of the 463 series, Mr. R. W. Urie is now dealing similarly with the 415 series, introduced some years ago. No. 421 has been dealt with first, and is now illustrated by the courtesy of Mr. Urie. Except that the boiler is now fitted with an "Eastleigh" superheater, and an extended smokebox is fitted, the changes involved are not great. In fact, the slide valves as originally fitted are retained, and the experience to be gained from this example will influence the future development of fitting superheaters to engines having flat-side valves. This engine has also been fitted with hot water injectors, sight-feed lubricator, tube-cleaning apparatus, and pyrometer. It has been extensively overhauled, and the opportunity has been taken to make a few modifications, with a view to obtaining greater simplicity in handling and reducing the cost of maintenance. It may be mentioned that No. 421 was the engine concerned in the disastrous Salisbury collision in 1906.

Leading dimensions, in regard to alterations due to the new equipment, are:—

Heating surface—small tubes ($1\frac{3}{4}$ in. diam.) ..	682 sq. ft.
,, large tubes ($5\frac{1}{4}$ in. diam.) ..	311 ,,
,, firebox ..	161 ,,
Total water surface ..	1,154 sq. ft.
Superheater	195 ,,
Total	1,349 sq. ft.
Steam pressure	175 lb.
Grate area	24 sq. ft.
Adhesion weight	35 tons 2 cwt.
Total weight of engine in working order	53 tons 4 cwt.
Total weight of engine and tender	98 tons 1 cwt.

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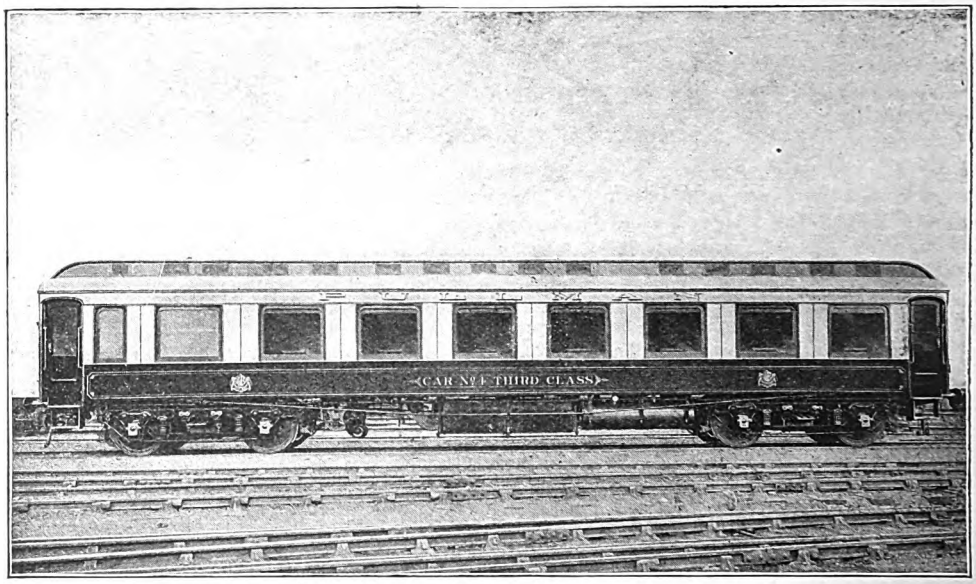

GENERAL VIEW OF ONE OF THE NEW THIRD-CLASS IN PULLMAN CARS.

"Pullman and Progress."

Third-Class Pullman Cars on the Brighton Railway.

SINCE the outbreak of war last year no more noteworthy example of British railway enterprise has taken place than the introduction of third-class Pullman cars into the services of the London, Brighton and South Coast Railway. The inaugural trip took place on September 10th and the first public journeys were made on Sunday, September 12th.

For nearly forty years first-class Pullman cars have been a valuable feature in railway travelling on the Brighton Railway. In 1876 a contract was made between the Pullman Company and the railway company and since that date Pullman cars have been systematically used on the various South Coast services. In two cases complete trains are made up, "The Southern Belle"—confidently claimed to be the most luxurious train of its class in the world—is operated in this manner on Sundays, when the complete set of seven of these magnificent cars is taken; but on week-days usually has a few third class vehicles attached, among which the new "Third-Class Pullmans" will now take their place. The "Eastbourne Limited"—running on Sundays only—has hitherto consisted of first-class Pullman cars only, but now takes its complement of "Third-Class Pullmans" in addition.

While the first-class Pullmans provide the maximum of luxury at the minimum of cost, the keynote of the new third-class Pullman cars is comfort. The constructional framework and the interior arrangements are on the familiar Pullman lines, the passage having on either sides tables with "tip-up" seats for four passengers, who, through the plate-glass windows which extend along almost the whole side of each division, have a splendid view of the country through which the train passes. The entrance vestibules and outer doors are in panelled mahogany, the interior panelling and tables are of polished oak, and the chairs are upholstered in crimson hair-cloth. The floors are covered with green linoleum, and a Wilton pile carpet is laid along the centre passage-ways. Ventilation is obtained through the top-deck lights on the clerestory roofs; ceiling and bracket electric lights give a brilliant illumination; and heating by steam from the engine is arranged on the

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"Decolite," supplied by Messrs. Bell's United Asbestos Co., Ltd., is used for the lavatory floors.

The three comfortable cars now in use run as follows :—

SUNDAYS.

11. 5 a.m.—Victoria to Brighton.
5.10 p.m.—Brighton to Victoria.
10.40 a.m.—Victoria to Eastbourne.
5.15 p.m.—Eastbourne to Victoria.

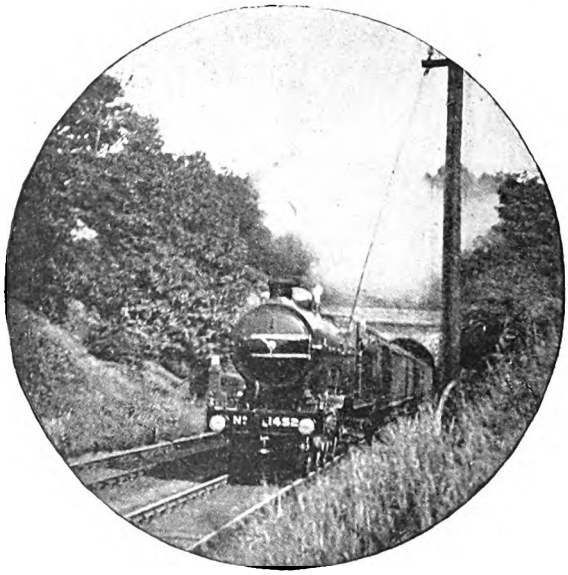
WEEK-DAYS.

11. 0 a.m.—Victoria to Brighton.
12.20 p.m.—Brighton to Victoria.
3.10 p.m.—Victoria to Brighton.
5.45 p.m.—Brighton to Victoria.
11.15 a.m.—Victoria to Eastbourne.
5. 5 p.m.—Eastbourne to Victoria.

Other cars of a similar kind are being built at the Pullman Company's works at Battersea, where the three experimental cars have been constructed under the direction of the works manager, Mr. H. Piedot, and to the approval of Mr. A. H. Panter, the Brighton Company's Carriage and Wagon Superintendent. The furnishing has been done by Messrs. Morison & Co., of Edinburgh, the whole of the work being under the supervision of Mr. Thomas Powell, Secretary and Manager of the Pullman Company.

Initial trips on Sunday, September 12th, and on the week-days immediately followed, witnessed a demand for accommodation in the new cars considerably beyond the number of seats available; but there is every indication that even when the novelty has worn off there will be a very wide support for this notable development on behalf of the third-class passenger.

A PICTURESQUE VIEW ON THE GREAT NORTHERN RAILWAY



Photo] *W. G. F. Kelly.*

DOWN EXPRESS LEAVING CRIMPLE TUNNEL.
4-4-2 superheater locomotive No. 1452.

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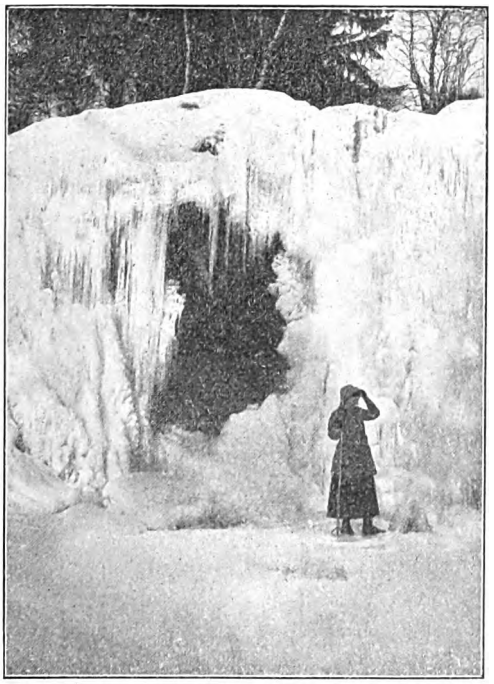
To Norway and Russia, *via* Newcastle.

"I rather would entreat thy Company
To see the wonders of the world abroad."
Shakespeare.

THAT Norway has much to offer the visitor in the way of scenic and tourist interest is now generally recognised; and no doubt many of our readers have participated in some of the tours arranged for the benefit of those desirous of spending a holiday in the land of fiord and forest, mountain and rocky cliff. Yet it is hardly realised how much this favoured land has to offer the traveller on holiday bent, and although in reality Norway is only a few hundred miles distant from our shores, there are large numbers of people to whom this northern kingdom is an unknown land, and notwithstanding the excellent and reasonable facilities now available, a journey thereto is still considered as akin to a voyage to far distant countries, requiring too long a time and involving too heavy expense to be included within the limits of an ordinary vacation.

It may be considered that under conditions such as those now existing even the suggestion that Norway should be visited, except of business necessity, is out of place. To such objection the reply may be made that international warfare is not a normal condition, and the time must come when peace will once more reign in Europe; but more important still is the fact that the very facilities which in ordinary times cater for tourist and like traffic, and have created the large holiday travel between Great Britain and Norway which has been developed in recent years, form the basis of services which in war time have rendered valuable assistance to the Allies, and have enabled us to maintain inter-communication and transport so vitally necessary to the existing situation.

This article, therefore, while appealing in many ways to the traveller desirous of viewing some of the world's grandest scenery and of experiencing the beauties of Nature as revealed in this northern land, has another object—that of directing attention to the inter-communication facilities between this country and Norway and Russia *viâ* Newcastle-on-Tyne, with some reference to how these services have been maintained under war conditions. It has been written by a British railway officer closely in touch with traffic passing by these routes, and on that account is of an authoritative character and of special value.



A WINTER SCENE IN NORWAY.

That Norway, up to the commencement of the European War, was making rapid strides as a holiday country for English people,

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and will make still more rapid progress after the war, cannot be denied, and, moreover, this progress is amply justified when the facilities available are taken into consideration. Comparatively little exploration of the interior of Norway has been undertaken up to the present, but when the advantages of the many tours arranged during the periods when travel is in demand, and the delights of mountaineering, fishing and rambling whilst staying at one of the numerous mountain hotels become better known, there is not the slightest doubt that travel to Norway will assume, both in summer and in winter (for "snow sports"), proportions which will make the already considerable traffic in normal times appear small by comparison.

The Norwegian cruising boats *Haakon VII.* and *Irma*, owned respectively by the Nordenfjeldske Steamship Company of Trondhjem and the Bergenske Steamship Company of Bergen, which companies form the Bergenske and Nordenfjeldske Line of steamers (B. and N. Line) from Newcastle-on-Tyne, have already received the patronage of many thousands of English folk, and it is with a short epitome of the history of these companies, and the important part their regular daily steamers from Newcastle have played during the war, that this article is mainly concerned.

MR. KR. LEHMKUHL, MANAGING DIRECTOR, BERGENSKE S.S. CO.

Very few people have paused to consider by what means communication with Russia has been possible for travellers since August 4th last year, or have been aware of the means by which the many thousands of Russian families who were holiday-making on the Continent when war broke out reached their homes. Regular travellers on the Great Northern Railway stared in amazement at the numbers of the Czar's subjects to be

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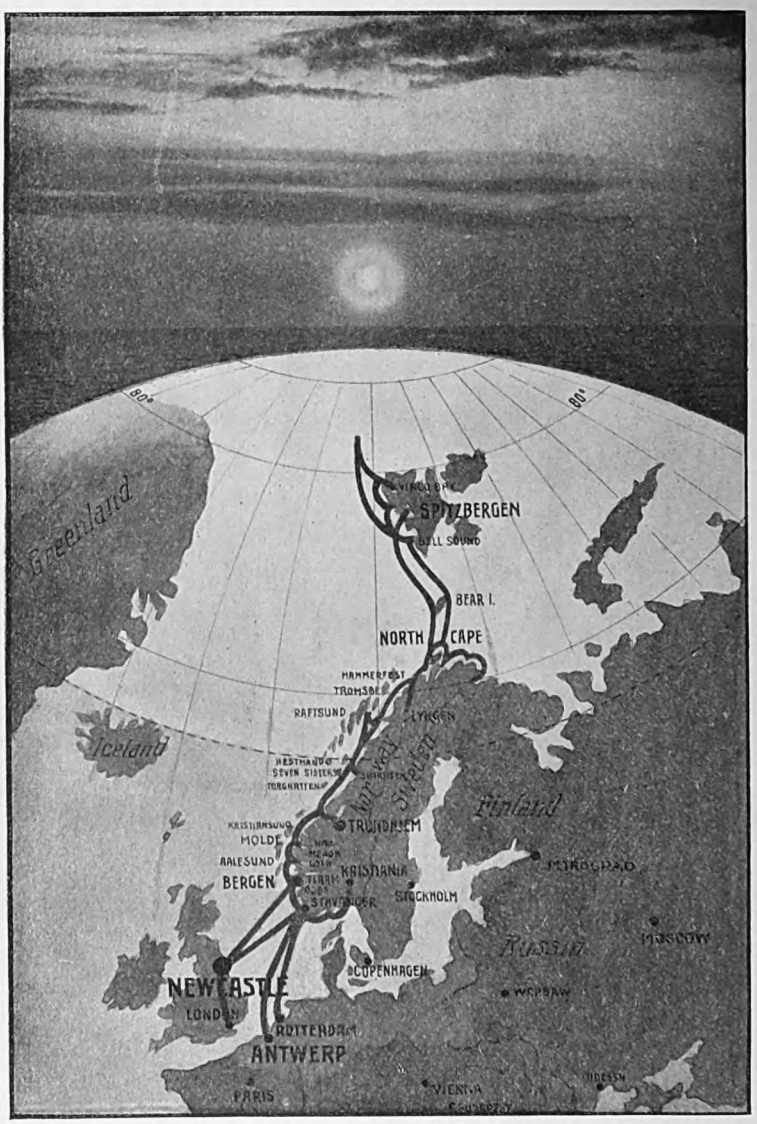
found in the principal trains from King's Cross daily during August, September and October, 1914, their destination being mainly Newcastle, to join the Bergenske and Nordenfjeldske Line boat for Bergen, thence by a magnificent scenic rail journey to Christiania and on to Stockholm and Petrograd, as graphically indicated by the illustration on page 319. One may perhaps ask whether this invasion of non-combatant Russians, homeward bound, had anything to do with the "Russian soldiers" legend of which so much has been heard.

The Bergenske and Nordenfjeldske steamers have, with hardly an exception, sailed every day, Sunday included, from Newcastle-on-Tyne across the North Sea to Bergen and Trondhjem with, of course, similar sailings arriving daily in Newcastle; and it is due to the energy, endurance, pluck and skill of the managements and their fine staff of seamen, that this very important and useful



MAP SHOWING ROUTES OPERATED BY B. & N. LINE STEAMERS.

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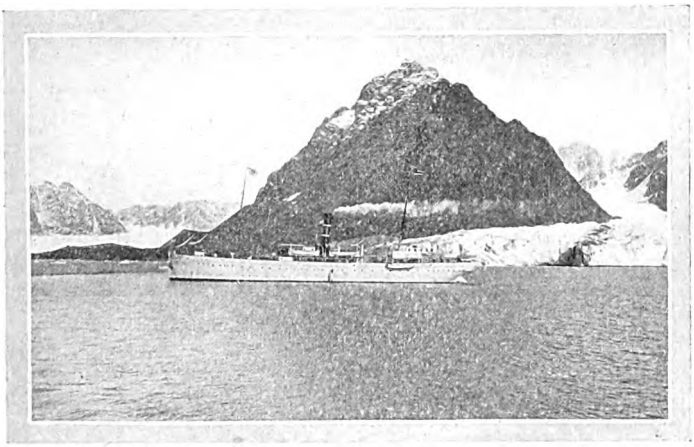
MR. E. BULL SIMONSEN, MANAGING DIRECTOR, NORDENFJELDSKE S.S. CO.

service has accomplished over 800 crossings since August, 1914, carrying tens of thousands of passengers without loss or injury to a single person, truly a record of note when the mine dangers of the North Sea and other obstacles to navigation during the last months of 1914 are remembered. This route from Newcastle-on-Tyne has been the only available means of reaching Russia (the Trans-Siberian Railway from Vladivostock, hardly a practicable route in war time, excepted) and the international character of the passengers may be imagined, travellers hailing from South America, the United States, India, Persia, China and Japan.

These, the two most important, Norwegian Steamship Companies, have a record of continual progress. The Nordenfjeldske Company was formed in 1857 with a capital of Kr.315,000 (£17,500); to-day it is Kr.6,500,000 (£350,000). The aggregate tonnage in 1857 of 560 tons has grown to 36,000 tons to-day, distributed amongst some 40 steamers engaged in regular sailings between Norway and Newcastle, London, Calais, Rouen, Archangel, Riga, and to ports in the Argentine and Brazil. The Nordenfjeldske Company's affairs are administered at Trondhjem by the Managing Director, Mr. E. Bull Simonsen, a man of great business capacity and of exceedingly broad views and who, notwithstanding his strenuous business life, finds time to hold several important public offices. He has been especially active in the development of tourist traffic and has, in conjunction with the Bergenske Company, given this country a great deal of attractive advertising literature, following up such publicity by providing the luxurious steamer *Haakon VII.* and other vessels on which many thousands have enjoyed the holiday of their lives "up North," to far Spitzbergen, and even penetrating to the ice field surrounding the North Pole.

The Bergenske Steamship Company commenced business in 1851 and in 1885 owned 15 steamers of an aggregate tonnage of 10,445; in 1900, 22 steamers (17,050 tons); and this year the Company's fleet numbers 46 boats, with an aggregate tonnage of 46,820. The capital the Company started with was Kr.306,000 (£17,000) and to-day is Kr.9,000,000 (£500,000). The latest vessel, which will probably come into service this month (October), marks an extremely important advance which will undoubtedly greatly encourage travel to Norway and beyond. This boat, the *Jupiter*, is a fast passenger vessel of 16 knots and 2,600 tons gross, and



B. & N. LINER AT SPITZBERGEN.

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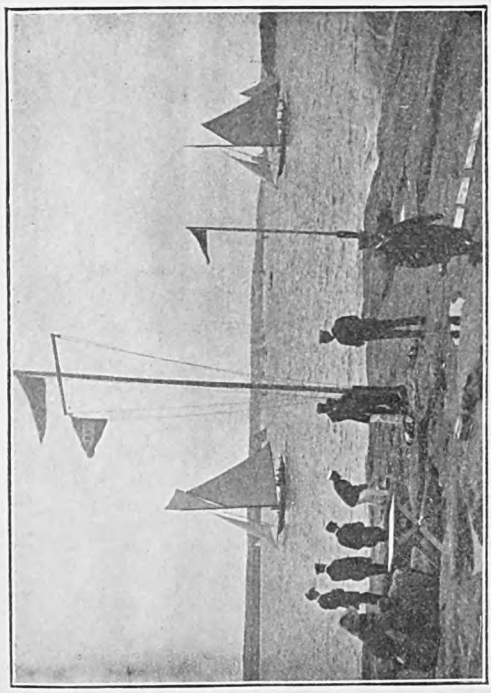
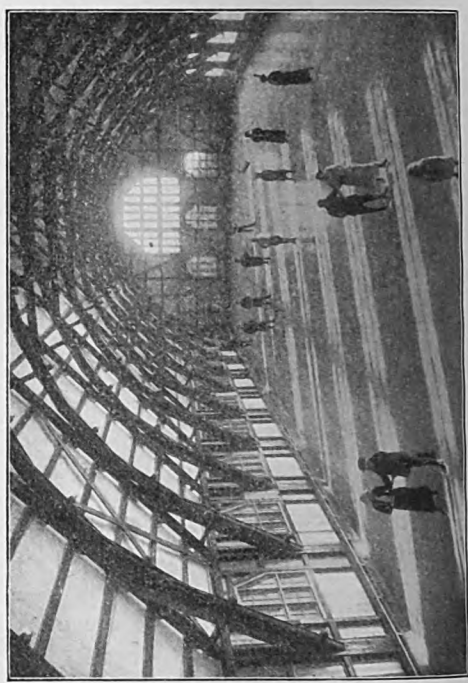
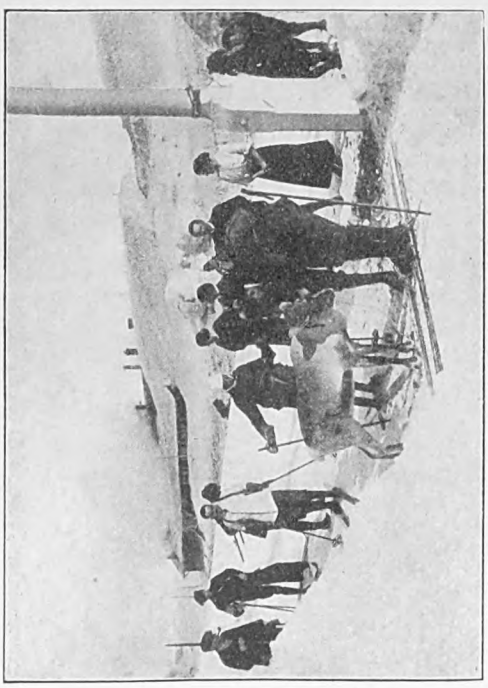


REGATTA AT HANKÖ SPA, CHRISTIANIA.

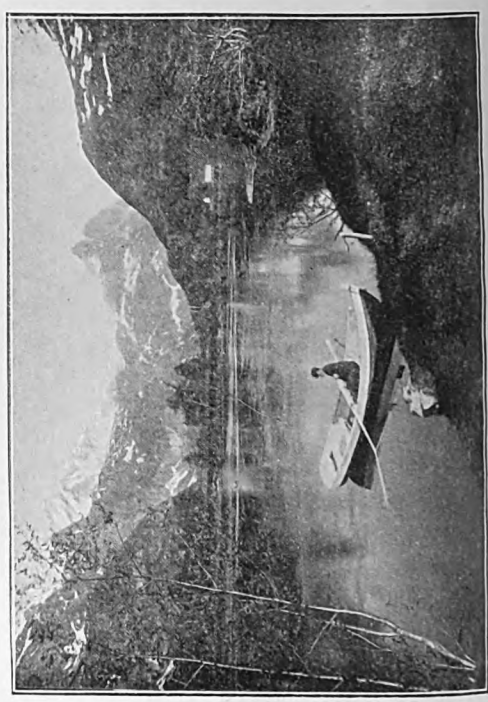


THE SKATING HALL (NATURAL ICE) AT FINSE.



THE PRINCE OF WALES AT FINSE, A WELL-KNOWN NORWEGIAN WINTER SPORTS RESORT.

The Prince is standing immediately behind the reindeer.



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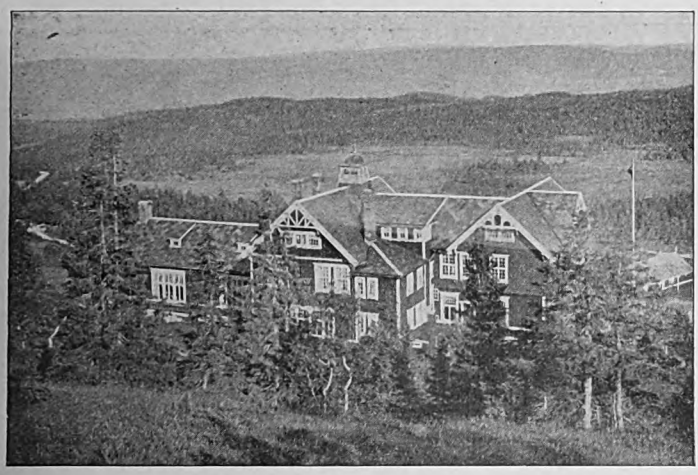


A MOUNTAIN HOTEL.

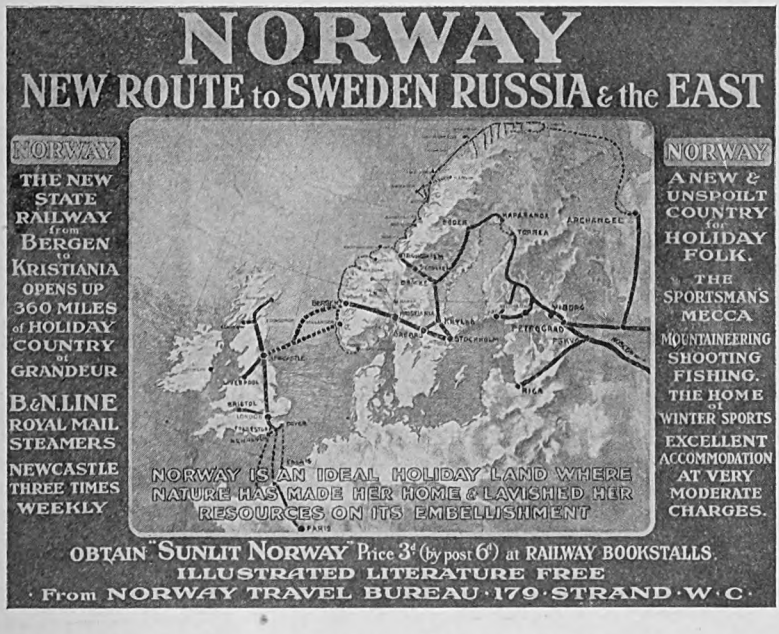
is intended to sail direct between Newcastle and Bergen, reducing the present time for crossing (32 hours) by several hours.

The Bergenske Company's headquarters are at Bergen and controlled by their Managing Director, Mr. Kr. Lehmkuhl, a gentleman well known through his many public services, having been a member of the Government as Minister of Public Works in the very strenuous and fateful years in Norwegian politics of 1905–6. Under Mr. Lehmkuhl's management the number of ships has increased from 32 to 46 and the capital of the Company doubled—sufficient testimony of his able control.

At the time of writing the Bergenske and Nordenfjeldske Companies jointly provide a service (two boats on Wednesdays) every day from Newcastle to Bergen, and thus have 16 passenger steamers entering and leaving Newcastle-on-Tyne each week.

I venture to think it will not be out of place here to say that the British, French and Russian communities, both commercial and private, fully recognise and highly appreciate the services of the two companies, their officers and crews for having accomplished in a singularly successful manner such important services under peculiarly difficult conditions.

"FJELDSÆTER."



AN INSTRUCTIVE POSTER ISSUED IN CONJUNCTION WITH THE B. & N. LINE OF STEAMERS.

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THE CANADIAN PACIFIC RAILWAY AND CAR LOADING.

CANADIAN PACIFIC RAILWAY COMPANY

Circular No 19

EASTERN LINES

THE STORY OF THE FREIGHT CAR

ITS DEVELOPMENT ON THE

CANADIAN PACIFIC RAILWAY SYSTEM

The 1903 Average Car	The 1908 Average Car	The 1913 Average Car
Tare 16.0 Tons Capacity 26.1 Tons	Tare 17.0 Tons Increase 6.3% Capacity 29.8 Tons Increase 14.2%	Tare 18.3 Tons Increase 14.2% Capacity 34.8 Tons Increase 33.3%

THE USE MADE OF IT BY THE RAILWAY Co's PATRONS ON ITS EASTERN LINES

in 1903	in 1908	in 1913
16.2 Tons Freight per loaded car	17.9 Tons Freight per loaded car	20.15 Tons Freight per loaded car

HOW TO SAVE $800,000.00 IN 1915

23.15 Tons Freight per loaded car

THE STATISTICS

	Actual Figures 1913	Proposed Figures based upon same amount of Business 1915
Average weight of Car	18.3 Tons	18.3 Tons
" " Contents	20.15 "	23.15 "
Average size of Train	19 loaded	18 loaded
	6 empties	5 19 empties
	25 Cars	23 19 Cars
Average weight of Train Tare	457 Tons	424 Tons
" " " Contents	383 "	416 "
	840 "	840 "
" " " Caboose	17 "	17 "
	Total 857 Tons	Total 857 Tons

EFFECT OF THE ABOVE UPON 3 OPERATING ITEMS

SAVING IN MILEAGE	Per Day	Per Year
Locomotive Mileage	2462	898 630
Car Mileage	113600	41,464,000
Ton Mileage	2,078,881	758,791,565

SAVING IN DOLLARS & CENTS	Per Day	Per Year
Locomotive Mileage	$272.90	$99,608 50
Car Mileage	773.61	282,367 65
Ton Mileage	1171.24	427,502 60
	Total $2217.75	Total $809,478.75

In the above no account is taken of the savings effected in :-
Per diem Account
Switching Service in Yards
Track expenses, &c., &c.

If Agents, Conductors, Yardmasters & others will secure the co-operation of Shippers & Consignees, and thereby succeed in increasing the average load in loaded cars by 3 Tons, it will result in an increase in the Co's net earnings in accordance with the figures given above

Mr. Alfred Price, Assistant General Manager, Eastern Lines, Canadian Pacific Railway, has issued a chart as above reproduced, the object of which is to indicate graphically the importance of realising proper freight car loading, thereby conducing towards increased efficiency in this respect.

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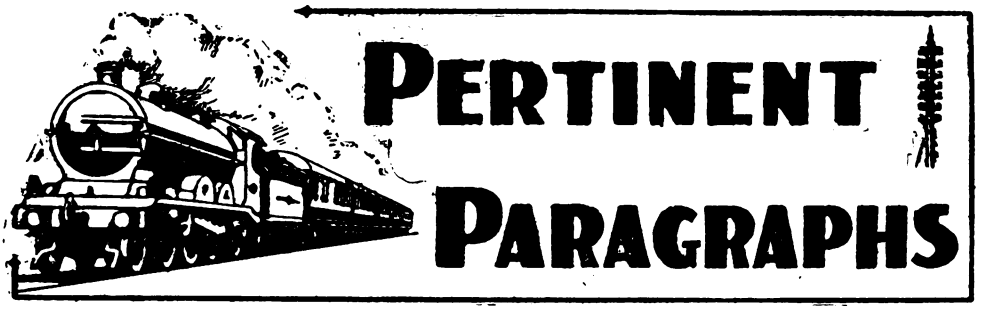

Railways and the Conveyance of Troops.

THAT war traffic entails a great deal of special arrangement of train working, often at very short notice, and with little time or opportunity to do more than to utilise conveninetly available engine power and rolling stock, is well known; and a contemporary summarises the general features of the work involved in the following brief account:—"Seated in a room in the headquarters of the traffic department are those whose duty it is to make all railway arrangements for the movement of the troops. Day and night—week-day and Sunday—in their turn, those officials are at their desk busily engaged in seeing that all the military requirements are met, and that our men are transported safely to wherever may be their appointed place. Being in direct and private contact with the military authorities, they are ever ready to make provision, even at short notice, for the transport of the troops. Word is received that '—— officers and men of —— Regiment are to be moved from —— to ——.' The amount of baggage to be conveyed, machine guns, etc., is also duly arranged for; and the necessary steps are at once taken to see that engines, carriages, and vans will be in readiness at the appointed hour.

"If the journey is to be a long one, then it will also be necessary to arrange for refreshments being provided *en route*. The details of the times of departure, and the passing times, the number of vehicles required, the class of engine, etc., are duly recorded in a circular, generally 'Roneod,' and sent out, but only to those whose duty requires that they should know of such movements. There is a twofold reason for the circulars in question being 'Roneod.' First, sufficient time is not always allowed to permit of the circular being printed in type; and, secondly, the fewer who know of the arrangements being made for the conveyance of the troops, the less possibility is there of the links in the secret chain being broken. And even the railway companies are not always 'in the know' of the whole movements of the troops by train—unless, of course, it concerns them directly."

Electrification Progress on the L. & N.W.R.

As yet the London and North Western Railway has little to show in respect of electric traction in active operation—the only sections so far in use being those run over by the West London services between Willesden Junction and Earl's Court, and the portion of the additional tracks used by London Electric trains which carry on the 15-min. service between Queen's Park and Willesden Junction (New station). But throughout the London area there are now abundant indications of the new era of transportation which a few months, depending upon the rate of progress which can be realised under war conditions, will produce. From Chalk Farm to Queen's Park work is in hand on the new electric lines, including the additional "tube" tunnels under Primrose Hill, which are already under weigh, as also the wonderful scheme of track alterations and inter-connecting "flying" and "burrowing" junctions at Chalk Farm. At Queen's Park the two car sheds for London Electric trains are almost completed, while the rebuilt station will be very different from the old one which it is gradually replacing. On the electric lines the additional Queen's Park tunnel is already in use by London Electric trains, and a new station is being built at one end thereof. And over the new local lines between Willesden Junction and Watford, over the North London Railway and elsewhere, conductor rails are already laid in many places, while the huge power station at Stonebridge Park and the various sub-stations are well advanced, in some cases almost ready for the inauguration of electric traction, though there is still much to be done before the whole scheme can be realised.

Electrification also involves the erection of carriage sheds and accommodation for the electric rolling stock, and large carriage sheds, complete with stores, mess-rooms, etc., are being erected at Willesden and Watford. At Willesden Junction provision is being made for the proper housing of some 170 vehicles on a site westward of the High Level Earl's Court line and southward of the main lines. The total area under cover will be close upon 18,000 square yards. Twenty-four running roads will provide accommodation for a total of 170 vehicles, each road having a break-pit for its whole length. The contractors for the foundations and general work are Messrs. Walter Scott & Middleton, and the works are under the immediate supervision of their engineer, Mr. L. C. Batting. The railway company's interests are looked after by Mr. Wood-Hill, the London Divisional Engineer, and his assistant, Mr. F. Baxter.

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Neath River Swing Bridge: Rhondda and Swansea Bay Railway.

In view of the opening of a new section of the line between the Neath River Swing Bridge and the junction with the Swansea District lines at Jersey Marine North signal-box, arrangements for the protection of trains passing over the Swing Bridge have been modified and improved. This bridge was constructed and brought into use in 1894, and was controlled from Neath Junction signal-box on the Neath side and from Dynevor Junction signal-box on the Swansea side. Owing to the construction of the new Neath loop, in connection with the new Swansea District lines in progress by the Great Western Railway, it was necessary to provide additional controlling devices at Jersey Marine North signal-box and Cardonnel signal-box. Mr. O. F. Smith describes the new equipment in the August *Great Western Railway Magazine*, and by the courtesy of the editor we are able to illustrate the bridge, and refer to the main features of the installation. Great Western standard pattern block apparatus is installed in the several boxes concerned, and this is controlled by means of track circuiting on all lines approaching and on the bridge. Control for the movement of the bridge is by means of an interlocking lever in Dynevor North cabin. Before the bridge can be swung from its normal position across the river, this interlocking lever in cabin must first be released. This release is obtained by the signalmen in Jersey Marine Junction, Cardonnel, Dynevor Junction South, and Neath Junction cabins each reversing an interlocking lever, which can only be done when the track-circuited sections for the respective boxes are clear of vehicles, and all points set so that it would be impossible to run a train over the bridge. When all these levers are reversed the bridge interlocking lever in Dynevor Junction North signal-box is free, and upon this lever being reversed it releases electrically the key-lever in a small locking frame in the bridge cabin, which, when reversed, gives release to the machinery for working the bridge.

The first operation is the lifting of the bridge about 1 in., in order to take the weight off the resting blocks. The blocks are then withdrawn and the bridge lowered again, after which it is opened to approximately 70 deg. After the bridge has been returned to its normal position, lifted, the resting blocks replaced, lowered again to rail level, and the key-lever replaced, the interlocking lever in Dynevor Junction North signal-box can then be replaced, which, in turn, allows interlocking levers in all the other signal-boxes concerned to be replaced, thus restoring "normal" conditions. Dynevor Junction North cabin is a new timber box constructed on brick piers and arches rising about 20 ft. from the old foundation level. It contains 39 levers and 8 spaces for any future additions that may be found necessary. All signals on the opposite side of the river to their respective boxes are electrically operated, which admits of their being placed the requisite distances away, while these signals are also controlled through the block instruments. The machinery for swinging the bridge is placed in a small cabin on the summit of the main bridge girders. They are of the oscillating cylinder type, worked by hydraulic pressure, and are in duplicate, each set being used alternately. The engine house proper is on the Neath side of the river, and contains a steam-operated plant for working the large rams supplying pressure to the bridge engines. The whole of the interlocking and track circuiting was carried out by the Great Western Railway signal department.

The Sir Edward Watkin Meritorious Conduct Fund.

In recognition of conspicuous acts of merit performed by members of the Great Central Railway staff during the year 1914, 102 awards have been granted from the Fund created by the late Sir Edward Watkin, Bart., M.P., and administered by the Trustees, Sir Sam Fay, General Manager, and Mr. Oliver S. Holt, Secretary. Seven of the recipients have for their courageous conduct also secured Certificates of Merit, and our Great Central contemporary gives particulars, to which we may refer briefly:

Driver J. Sandall, Gorton; Foreman Shunter D. Owen, Manchester (London Road). On the 21st March, as the 7.45 p.m. Manchester train, Hayfield to Manchester, was entering London Road station, a shunter named Boyd came out of the shunters' cabin and apparently not noticing the approaching train stepped in front of it. He was knocked down and fell between the platform and the rails. Sandall and Owen observed the accident, and the former immediately lay flat on the platform (C) ramp end, while the latter lay down under the ramp, both holding Boyd down until the train had passed into the station. The rescuers incurred considerable danger to themselves, not only from the passing train, but from the risk of passengers opening the carriage doors.

Acting Permanent Way Inspector R. Vessey, Barnetby. At the imminent risk to his life, Vessey, on the 15th July, was the means of preventing an aged man from being knocked down and run over at Grimsby Town. With commendable presence of mind, Vessey rushed to the man and pulled him almost from under the wheels of a passenger train, holding him in the "six-foot" until the train had got clear.

Porter H. Vessey, Grimsby Docks. On 19th March the 5.45 p.m. passenger train Cleethorpes to Lincoln was running into Grimsby Docks station, and at the same time a train of empty wagons was being propelled on the Up line to the East side of the Royal Docks. A shoe-black named Peters, a cripple who walks with the aid of two sticks, was proceeding from the Down

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to the Up side of the line over the level crossing when, in stepping over the outside rail of the Up line, one of his sticks became wedged between the running rail and a switch-end, and he was thrown down in front of the oncoming wagons. Porter Vessey saw the man's plight and at very great risk to himself, both from the train of empty wagons and the passenger train, sprang forward and succeeded in dragging the man clear.

RELIEF SIGNALMAN J. HAYWOOD, Langwith Junction. Haywood, on 27th June, was acting as Relief Stationmaster at Spink Hill, and whilst in the office he heard someone shouting "keep back." He at once went to ascertain the cause, when he saw a passenger (Mr. Twigg) leisurely crossing the line between the platforms, notwithstanding the fact that the 2.0 p.m. passenger train Mansfield to Sheffield was entering the station. Haywood jumped on to the line and unfortunately slipped on a greasy sleeper, but succeeded in getting hold of the man and dragging him down to the ground. The train was then only about 30 yards away, and, still clinging to the man, Haywood rolled over the rails with him, just as the train passed over the spot.

ASSISTANT FITTER C. HILL, Marylebone. On 8th November, Fitter Brown and Assistant Fitter Hill were working on the top of a 30-ton electric Goliath crane when, about 9.45 a.m., the former was suddenly seized with some sort of fit and struggled with Hill, who, however, had the presence of mind to tie a rope round Brown and fasten him to the stanchion of the crane. He was afterwards lowered down and taken to the hospital, but died during the afternoon.

CAPTAIN A. HARRISON, Immingham. Very valuable aid was rendered by the Captain and Crew of the Tug *Central No.* 2, on 15th August, in towing H.M.S. *Bullfinch* from the Ross Spit buoy to Immingham, she having been in collision in the North Sea.

Indian Railways and Munition Work.

ACCORDING to the *Indian Railway Gazette*, Indian railways are now rendering assistance in the manufacture and supply of munitions for the Allied fighting forces. Long before the formal announcement was made the question of placing at the disposal of Government the facilities possessed by the principal railway workshops in India was under consideration, and this culminated in a meeting, held in Calcutta, of railway officers to discuss the best means of co-operating towards obtaining the best results and the largest possible output in the direction indicated. All the necessary arrangements are now completed, and the manufacture of munitions is now in active progress. Work is under the direction of Mr. Victor Bayley, who, previous to his appointment to the newly-created position of Superintendent of Munitions, was Assistant Secretary of the Railway Board's Stores Department. The administration of the new department has been entrusted to the Railway Board. In a recent interview, Mr. Bayley explained that the position of the Munitions Department would be that of contractor to Government on a huge scale, under the inspection of the Ordnance Department. When the question of supplying munitions was first raised, private manufacturers and the heads of the principal railway workshops in India were invited to a conference at a Government arms factory, when specimens were exhibited of what was required. The railway engineers expressed their ability to turn out shell bodies according to specification, these to be shipped to England in quantities to be charged there. General work in railway workshops is to be suspended as far as possible so as to give every facility for the speedy output of munitions.

The Weedon Accident.

PENDING Col. Druitt's report to the Board of Trade, little can be said in reference to this serious accident, wherein 10 passengers were killed and many injured. The trains concerned were the second part of the 8.30 a.m. down Irish Mail, drawn by No. 1971, *Euryalus* (a "Precursor"), with No. 1189, *Stewart* (a "Precedent") as pilot, and the 8.45 a.m. up fast train from Birmingham, drawn by No. 1489, *Wolfhound*, a 4-4-0 superheater engine. The latter engine afforded the primary cause of the disaster, the right-hand coupling-rod apparently coming off the driving pin and ploughing up the permanent way, with the result that the down express, which was passing at the time, was derailed, all casualties being in the "innocent" train. It remains to be seen where Col. Druitt will apportion the blame, or whether the accident will not have to be reckoned in the category of those due to a combination of untoward circumstances, or, as it might be expressed in shipping parlance, to "Act of God," or attributable to circumstances unforeseeable and operative under certain conditions only and without fault of any one concerned.

There is no need to review the circumstances of the accident, which have been dealt with fully in the ordinary press, but we may refer to the curious uncertainty of various accounts as to the identity of the rod which came loose. It was generally described as the "connecting rod" —of an inside-cylinder engine!—but was also mentioned as the "crank rod," and the "steel rod of the bogie wheels." Another statement was that "a heavy steel communicating rod . . . broke and fell on the permanent way," while a further version was "the steel rod connecting the off-wheels of the engine." A morning paper excelled itself, its description being written by a "Railway Expert," by stating that "the Irish

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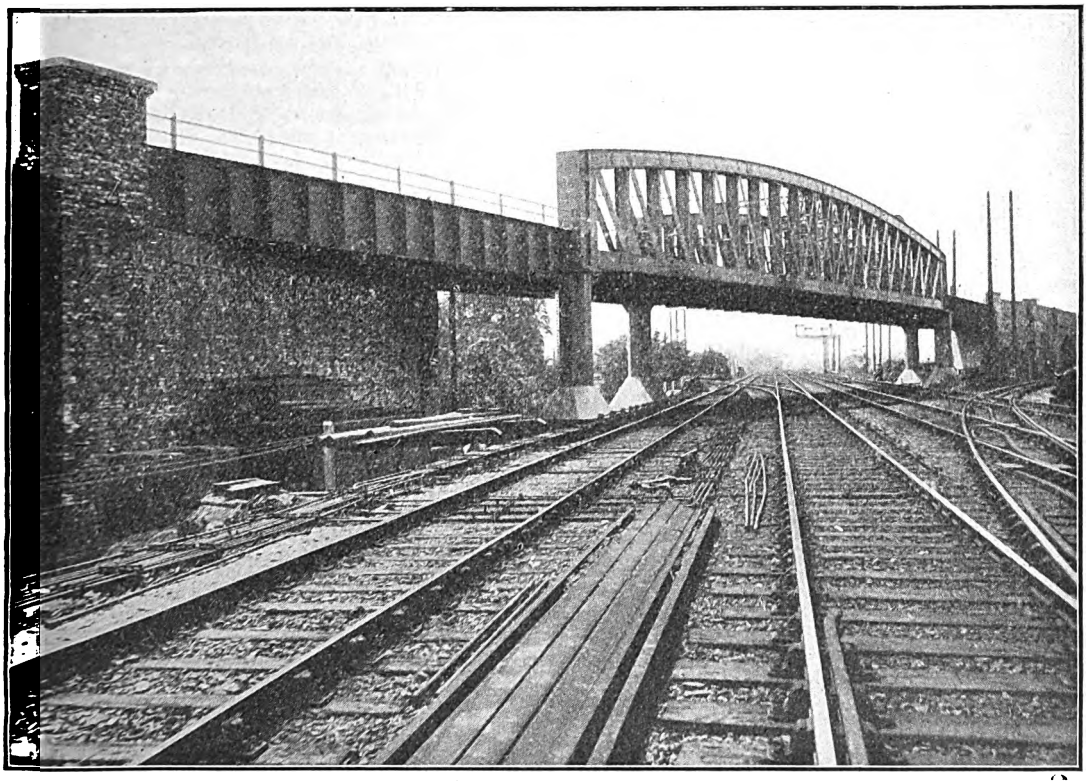
Mail was drawn by two locomotives, the *Stewart*, a *non-front bogey engine*, and by the *Euryalus*, with *leading bogey wheels*. . . . The heavy steel rod of the up engine broke under the strain of the mighty blows it was delivering in its impact with the permanent way."

The Hampton Court "Fly-Over": London and South Western Railway.

REFERENCE has already been made to the works in hand at Hampton Court Junction, to enable branch trains to Hampton Court to diverge from the London and South Western Railway main line without fouling any other tracks; and now, by the courtesy of the editor of *The South Western Railway Magazine*, we are able to illustrate the principal feature of the work, the bridge carrying the new down line for the branch across the main lines. The new line is 1½ miles in length, and includes a viaduct 336 yds. long, another 100 yds. in length, several public road bridges, and the fly-over bridge which has the longest single span on the London and South Western Railway, viz., 160 ft. With the exception of this bridge, the whole of the work was carried out by the railway company's own staff.



FLY-OVER BRIDGE CARRYING NEW DOWN BRANCH LINE, OVER MAIN LINES, FROM HAMPTON COURT JUNCTION: LONDON AND SOUTH WESTERN RAILWAY.

Recollections of the Old Bodmin and Wadebridge Railway.

LAST month a photograph was reproduced showing one of the old Bodmin and Wadebridge passenger carriages now exhibited on a pedestal at Waterloo station. *Apropos* thereof some extracts from a letter published in a West country contemporary, the *Morning News*, will be of interest. The writer Mr. C. Ellery, an old volunteer, states that he well remembers the carriage when it was in use on the old Bodmin and Wadebridge Railway, and has ridden in it on many occasions, and also an old open coach that was in use at the same time. "The superintendent of the line at that time was Mr. Hayes Kyd, and for his tours of inspection he used the open coach, drawn by a horse in shafts, which were attached to the carriage by a short chain." Speaking of his volunteer days when he resided in Wadebridge, Mr. Ellery states that "In the early days of the old Volunteers, and when they went to battalion drills, we used to have a special train from Wadebridge to Bodmin, and all the carriages were required to take the 13th Company away and fetch them again on the return journey. If the drills were away from Bodmin the company

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would fall in and march to the Royal Hotel, and from there in large four-horse 'busses drive to Bodmin Road station (then the Cornwall Railway.")

He continues: "I also remember well the old locomotives that were in use on the Bodmin and Wadebridge Railway, the first types of locomotives; their names were the *Camel* and the *Elephant*. An uncle of mine was an employé on the line from the opening, and was employed first to ride on the front or buffers of the engine, to jump off and open the gates to let the train pass through, then shut the gates and run and mount again. From this he was promoted to fireman, and, meeting with an accident at the Helland Bridge Wharf or station, was disabled for a time. When he recovered from this he was appointed wharfinger or stationmaster at Bodmin, where he remained in charge until the old system was finished with and the present system of working it as a passenger line was established. Then the old man was pensioned off by the London and South Western Railway Company."

"I Can't Stay To-day"—for the Train!

MR. ELLERY then tells several anecdotes of the old line, some of which are new to us, and may be quoted. "A cottager or farmer's wife, using the railway as a footpath, which was frequently done in those days, going to Bodmin with her heavy baskets on her arms, was overtaken by the train, and being well-known by the driver and men in charge of the train was asked if she would like to ride. She replied, 'No, thank 'ee, I can't stay to-day.' The explanation was that the train went at first as far as Grogley and made the first stop, and taking part of the train went on over a branch of the line to Ruthern Bridge Wharf, where the wagons were run on to a staging and sand or coals were tipped. After shunting, etc., and after coupling up trucks of iron ore, and cutting into one of the farmhouses near and having a drop of cider, the driver would make a start for the main line, couple up, and the next place of call would be Nanstallon, where the tipping, etc., would have to be performed as before. These are the reasons that the woman could not stay or afford the time to ride."

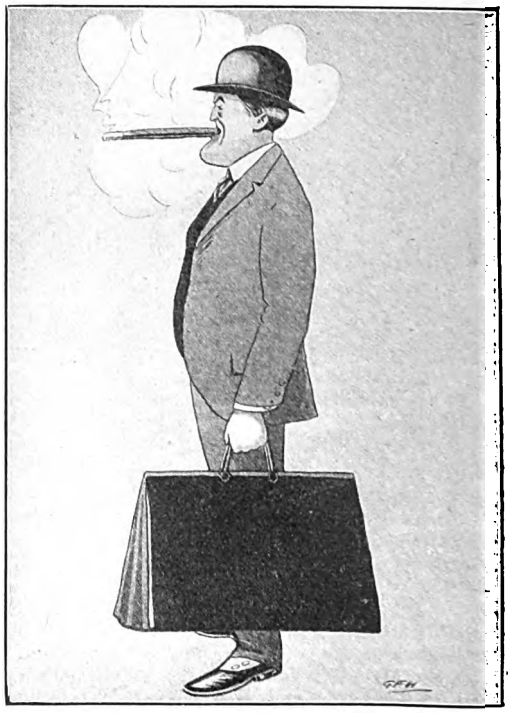
"The only accommodation for passengers was one of the old carriages attached to the mineral or luggage train, which used to run about every other day, and eleven o'clock was the time of starting. On Saturday there was a special market train which used to start for Bodmin at 2 p.m.; at 1.45 three blasts of the engine whistle; 1.50 two blasts; and at 1.55 one blast; these blasts of the whistle were to let people or intending passengers know that the train would leave at 2 p.m. I think in more modern times there was another or later train to Bodmin market."

"Trevithick" Locomotives on the L. & N.W.R.

THAT interest is still shown in sections of Mr. Ahrons' articles published several issues back is evidenced by a letter recently received from Mr. C. Williams, of Crewe. He writes: "Referring to the list of London and North Western Railway Trevithick singles, given by Mr. Ahrons in his article 'Locomotive and Train Working in the Latter Part of the 19th Century' (second part), on page 140 of the February RAILWAY MAGAZINE, I now find that No. 137, *Crane*, which through some reason or another I had overlooked, was a 5 ft. 2-4-0 outside-cylinder 'Crewe' goods engine, not a 6 ft. single, as there shown. This engine like the rest of the 'Crewe' goods, ran latterly without a name, the practice of naming goods engines being discontinued some time previous to the date referred to in Mr. Ahrons' article."

Sir Guy Granet in Caricature.

A CARICATURE may be described as a portrait in which, with a lesser or greater degree of exaggeration, emphasis is laid upon some characteristic pose or mannerism which tends to give individuality to the subject. Mr. G. F. Hudson, of Kegworth, near Derby, sends a friendly caricature of Sir Guy Granet, General Manager, Midland Railway, and we have pleasure in reproducing this. The artist has cleverly suggested a characteristic attitude of his subject, and that he has achieved his object with a remarkable degree of success is shown by the fact that it is viewed with approval by Sir Guy Granet and his family, to whom it has been submitted.



SIR GUY GRANET.
General Manager, Midland Railway.

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Conversion of Electric Current Supply: City and South London Railway.

PENDING the complete transformation which will be necessary when the City and South London Railway is connected for through running with the London Electric Railway, and motor-coach and trailer trains take the place of the locomotives and vehicles at present utilised, an important change has been made in the system of current supply, in order to realise the benefits of centralisation of power at the Lots Road power house, the City and South London being included in the lines controlled by the Underground Electric Railways Company of London, Ltd. The change was made on June 13th, since when current has been obtained entirely from Lots Road instead of from the old power house at Stockwell. The alteration very nearly coincides, too, with the appointment of Mr. P. V. McMahon, engineer to the City and South London Railway throughout the whole of its operative history, to take charge as superintendent of power at Lots Road, in succession to Mr. J. W. Towle, who recently left England to take up an important appointment abroad.

As rearranged a.c. current is now supplied from Lots Road at 11,000 volts direct to three sub-stations, pending the completion of a fourth, through ordinary British Thomson-Houston converters and transformers reducing and transforming to 600 volts d.c. to the line. The rails are used for the return current in view of the equipment of the line ; but, speaking generally, the system of working is now that which usually obtains except for necessarily special characteristics, and until the enlargement and entire transformation of the line is completed, in conjunction with the enlargement of the tubes and the introduction of usual electric rolling stock. The three sub-stations in use are at Euston, Old Street and Elephant and Castle, while the fourth will be at Stockwell. At Euston the London Electric sub-station is utilised, there being now four rotary converters, two for the Hampstead line and one or two available as required for the City and South London Railway. Old Street is a new sub-station erected adjacent to the station, and containing four converters, though at present one or two are sufficient for the traffic. The Elephant and Castle sub-station is also a new one, and is shared with the London Electric Railway, with two converters for each line. The Stockwell sub-station will contain four converters. The original premises at Stockwell will remain as a depôt for rolling stock and repairs, the power station being dismantled.

It is anticipated that in due course the Central London Railway will also be supplied from Lots Road. In that case, however, the station at Shepherd's Bush will become a converting station, converting 11,000 volt a.c. current to 6,000 volts, thence distributing to the sub-stations as at present, except that the converters will require speeding up to provide for the frequency being 33⅓ cycles.

Motor Hospital and Ambulance Cars for War Service: Victorian Government Railways.

EARLIER in the war the staff of the Victorian Railways originally contributed for patriotic purposes a sum of £9,997, of which the amount allocated to the Belgian Relief Fund was £3,345, and the amount devoted to the relief of the unemployed in Victoria was £3,300. It was arranged that the balance of £3,352 should be devoted to the construction, at the Newport workshops, of a motor hospital, a motor ambulance, and a travelling kitchen, for the use of the Victorian troops. The motor hospital cost, approximately, £1,500 ; the motor ambulance, £550 ; and the travelling kitchen, £400 ; or a total of £2,450 ; leaving a balance of £902. from which two motor ambulance wagons are now in course of construction. The motor hospital car is fully equipped with the surgical instruments and dressings, splints, etc., and is understood to be the first of its kind in the world. It is virtually a portable operating theatre, equipped upon a 16 h.p. "Thornycroft" chassis. In the centre of the car is a nickel-plated operating table, 6 ft. long by 18 in. wide, of which 18 in. at each end is hinged, and can be raised or lowered as required.

The travelling kitchen is designed on the assumption that no provision need be made for roasts, but solely for stews. It consists essentially of two two-wheeled carts fitted together, and the complete unit is proportioned to cook for about 260 men, being entirely self-contained. Each of the motor ambulance cars is arranged to accommodate four patients, there being two stretchers on each side of the car, one above the other, with a central passage, 18 in. wide, and a hinged seat for an attendant at the front end. Each stretcher is carried on hinged brackets, which can be swung out of the way when not required. All equipment required in the field is carried in two lockers, one on each side, under the bottom stretcher. Accommodation is also provided for four men on the front seat. The inside dimensions of the car are 7 ft. 8 in. long by 5 ft. 6 in. wide, and 6 ft. high.

Electrification of Suburban Lines: London and South Western Railway.

THIS work has now been in progress for some time ; and it is expected that electrical working will be commenced very shortly, at first for the Waterloo-Wimbledon route *viâ* Southfields, and then over the Kingston roundabout route. The first step of the scheme involves the equipment of about 150 single line miles of track for electric traction, with a route length of about 48 miles, and includes the electrification of the Waterloo and Wimbledon line, *viâ* East Putney, the "Kingston Roundabout" line *viâ* Wimbledon and Richmond, the loop line from Barnes to Twickenham *viâ* Hounslow, the Thames Valley line to Shepperton and also the lines between Malden and Hampton Court and Hampton Court Junction and Claygate.

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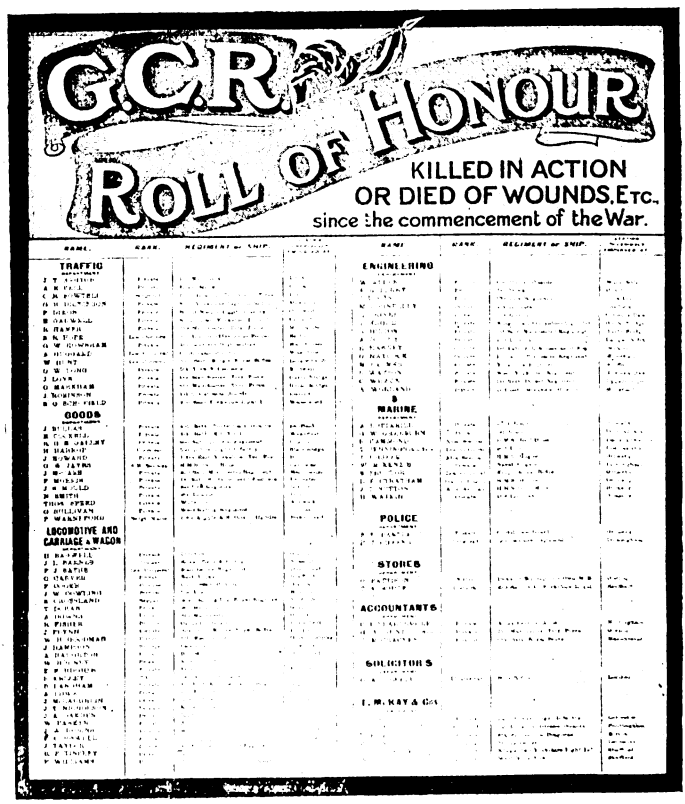
The power house is at Durnsford Road, Wimbledon, close to the railway. The constructional work is completed and a considerable portion of the machinery is fixed. Sub-stations have been built at the following places: Waterloo, Clapham Junction, Raynes Park, Kingston, Twickenham, Barnes, Isleworth, Sunbury, and Hampton Court Junction. These buildings are all complete and are being equipped with static transformers and rotary converters, together with the necessary switch-gear for converting the three-phase alternating current into direct current at 600 volts, at which pressure it will be supplied to the conductor rails, the running rails being utilised for return. The trains, of which a sufficient number are already available, are arranged in units of three coaches, which will be permanently coupled together, and it is intended to work these units as three and six coach trains according to traffic requirements.

"A Family Affair."

A GREAT Eastern Railway Driver, Mr. C. Howard, of Yarmouth, sends particulars of an interesting family record:—"Not long ago an up Yarmouth to London express train, on its arrival at Liverpool Street station, was met by the time-keeper as usual, when the following conversation took place:—

"Time-keeper to Guard next engine: 'Are you head Guard?' 'No!' Time-keeper: 'Do you know who is?' 'Yes! Harry Howard.' Time-keeper: 'What is your name?' 'Dan Howard.' Time-keeper: 'Do you know the Driver's name?' 'Yes! Charles Howard.' Time-keeper: 'Are you any relation to one another?' 'Yes! All three brothers.' Time-keeper: 'Well! that takes the biscuit. In all my experience of over thirty years, I have never known three brothers to be in charge of a train. I have known three men of the same name to be in charge of one train, but of no relationship to one another; and in other instances perhaps two have been brothers, or relatives, but never three brothers.'" Mr. Howard remarks in conclusion that "these three brothers, like 'Charley's Aunt,' are still running."

A NEW "ROLL OF HONOUR": GREAT CENTRAL RAILWAY.



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LAST month we referred to the honour conferred by the President of the French Republic upon Mr. F. H. Dent, General Manager, South Eastern and Chatham Railway. On Wednesday, August 25th, Monsieur Albert Sartiaux, General Manager and Chief Engineer of the Northern Railway of France, and his principal officers gave a dinner at the Constitutional Club to Mr. Dent to commemorate the honour bestowed upon him. Mr. Alfred Sire, M.V.O. (the British representative of the Northern Railway of France), presided, and Monsieur Felix Sartiaux (Assistant to the General Manager) represented his father, Mons. Albert Sartiaux. Before the dinner Mons. F. Sartiaux attached to Mr. Dent's breast a replica of the Order mounted with diamonds, explaining that it was a gift from his father and a few of the chief officers of the Northern Railway as a mark of high esteem. British railway interests were represented by: Sir Herbert Walker, Acting Chairman of the Railway Executive Committee, and General Manager, London and South Western Railway; Sir Guy Granet, General Manager, Midland Railway; Mr. Donald Matheson, General Manager, Caledonian Railway; and the following officers of the South Eastern and Chatham Railway: Messrs. P. C. Tempest (Chief Engineer), E. C. Cox (Superintendent of the Line), R. E. L. Maunsell (Chief Mechanical Engineer), W. Woodman (Chief Accountant), F. P. Igglesden (goods Manager), and Captain Churchward (late Paris agent). There were also several other French and British guests representing various war and other agencies.

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IN our last issue mention was made of London and North Western men who have been granted distinctions for gallant actions whilst serving with the Expeditionary Forces, or have been mentioned in despatches, and the following additions will be of interest. *Awarded Distinguished Conduct Medal, etc.*—J. F. Condrey, Lance-Corporal, No. 8280, 1st Royal Welsh Fusiliers, formerly a labourer in the Locomotive Department at Crewe. He has also been awarded the Medal of St. George, 4th Class, by His Imperial Majesty, the Emperor of Russia, the same distinction having been conferred also upon Company Quartermaster-Sergeant J. Fearnchough, and Private E. Salisbury, mentioned last month.

THE UndergrounD Railways and London General Omnibus Companies have in course of preparation a series of illustrated booklets dealing with notable features of London and its environs. Some twelve subjects will be touched upon, among them The Tower, Zoological Gardens, City Churches, Hyde Park, The Markets, and St. Albans. Each booklet will consist of 16 pages, with 12 or more original photographs, and sketch maps of the places described. Judging from those already issued they will be excellent examples of artistic printing. Incidentally they are quite free from advertising matter, and can be commended in every way. The first two booklets, "The Tower," and the "Zoological Gardens," are now ready, and copies may be had free of charge on application being made to Stationmasters at the UndergrounD stations, or to the Advertising Manager, Electric Railway House, Broadway, Westminster, S.W. These will be followed by a booklet on "City Churches," and another treating of the subject familiar to all, but one which has thus far not been accorded practical treatment from a literary point of view, *viz.*, "A Motor-Bus Tour through the Centre of London," giving in tabulated form all the features of interest passed *en route*, and having no fewer than 75 illustrations, many of them depicting buildings which have hitherto not come within the focus of the camera. Other subjects will be:—London Markets, Kew Gardens, Hampton Court, Hyde Park, St. Albans, Richmond, Epping Forest, The Cathedrals of London and Shipping.

* * *

ONE of the difficulties attending the use of long cars on electric railways is that where stations are located on curves it is sometimes impossible to avoid relatively wide spaces between the station platform and the car floors inside end doorways. An instance is the Bank station of the Central London Railway, where the injunctions of the trainmen to "mind the step in getting on" call for careful attention. The Pennsylvania Railroad has built high station platforms at its New York terminal, at Manhattan Transfer, Rahway and North Philadelphia and has similar platforms under construction at Wilkinsburg and Johnstown on its Pittsburg division; and at some of these stations, also, the same difficulty has arisen. A steel vestibule car has, therefore, been built for trial fitted with

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MR. A. C. HUTCHERSON,

District Goods Manager, Great Eastern Railway, Cambridge.
His retirement dates from 30th September.

an extensible trap door designed to bridge the gap between the car and the station platform. When the trap is down the opening of the vestibule door causes the sliding portion to extend beyond the side of the car; closing the door returns it to its normal position. When the trap is to be raised for the use of the step, or when the brakeman opens the door while the train is moving, the trap does not need to be extended. To provide for this a small handle is set flush in the end of the car body, by means of which the connection between the door and the trap extension may be disengaged.

* * *

MR. R. F. C. CASTLEMAN, District Goods Manager at Crewe, London and North Western Railway, retired at the end of August. Mr. Castleman's whole career has been spent with the London and North Western Company, and his service of no less than 52½ years has the distinction of being a longer period of continuous employment than any other officer now in the Company's service has realised. Commencing at Haydon Square in 1863, the first thirty-nine years of his official life were spent in London, where he occupied various positions of increasing importance in the goods department, including those of agent at Camden and Broad Street, until he reached that of District Goods Superintendent, to which post he was appointed in 1893, in succession to the late Mr. Grasemann. This position he retained until 1902, in which year, shortly after the opening of the new tranship shed at Crewe, he was appointed Goods Manager of the Crewe district, and remained there until the time of his retirement. Mr. Castleman is succeeded by Mr. F. P. Kinsman, District Traffic Superintendent at Shrewsbury.

* * *

FROM the 1st of August, Mr. Cecil F. Grasemann ceased to deal with Staff matters at Euston, but, as assistant to the General Manager, took over the charge of the Publicity Department of the Company, and all matters relating to advertising, &c. All other matters hitherto coming under his supervision he retains. Mr. Grasemann is one of the most popular chiefs at Euston. As Chairman of the London and North Western (London) Athletic Club he comes much in contact with members of the Staff, and no function or meeting, serious or social, is considered complete without his genial presence. Most certainly it can be stated that practically every one of the organisations at Euston for the welfare and benefit of the Staff owe their success in no inconsiderable degree to his care and unflagging interest. Mr. Grasemann's personality cannot fail to ensure his success in his new position, but it is accepted as a *sine quâ non* by his colleagues that he must continue his associations and interest in the "personal" and social life of the Staff.

* * *

MR. ALFRED CHARLES HUTCHERSON'S retirement from the position of District Goods Manager of the Great Eastern Railway at Cambridge dates from September 30th. The whole of Mr. Hutcherson's business career has been spent with the Great Eastern Railway. Entering the service in 1866, at the early age of 14, his first appointment was as junior clerk in the Wisbech booking office, from whence he was transferred to Huntingdon (Godmanchester) as booking clerk. In 1869 he entered the District Superintendent's Office at Cambridge, and became relieving Station Master for the district and was later appointed Station Master at Shelford. After gaining further experience at Ipswich he was transferred to the Goods Department at Liverpool Street and in 1880 succeeded to the post of Sack Superintendent at Ely, which position he held for 21 years until in 1902 he succeeded the late Mr. William Roper as District Goods Manager at Cambridge. Mr. Hutcherson was held in the highest esteem by his staff. He was president of the Cambridge branch of the St. John's Ambulance Association, the Cambridge (G.E.R.) Swimming Club, the Great Eastern Railway (Cambridge) Cricket Club and of the Cambridge Miniature Rifle Range. Mr. Hutcherson is the fortunate possessor of an infinite capacity for making friends and as a consequence has for a long course of years been a particularly popular personage among the farmers and merchants throughout the Cambridge district. His genial presence at market, corn exchange, and in trains serving the railway area under his supervision will be greatly missed.

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Cross Society was started at Banbury station, Great Western Railway. Nurses are in attendance daily, working in relays from 7 a.m. to 10 p.m., and are prepared to attend during the night as well. They supply troops arriving at or passing through the station with refreshments, consisting of milk, cake, sandwiches, tea, coffee, lemonade, and fruit, also postcards to write to their friends and relatives. Early in the war they attended to something like 3,000 troops a day, and during one week served 16,000 troops and eight hospital trains, representing over 1,000 wounded. It was calculated recently that refreshments had then been supplied to 350,000 troops. It is understood that the organisers of the Fund at Banbury were the pioneers of this excellent work, which has since been taken up widely throughout the country.

* * *

A RECENT list of honours contains the name of Herbert Horace Purnell (Assistant Stoker at Neasden Power House, Metropolitan Railway) now serving in the "Hood" Battalion, Naval Division at the Dardanelles, who has been twice commended for behaving in a gallant and courageous manner in action at Cape Helles and has received the Distinguished Service Medal, which circumstance has naturally given intense satisfaction to the executive of the Railway and also to his colleagues who, for various reasons, have had to remain in England.

* * *

THE position of District Traffic Agent in Belfast for the Midland, London and North Western, and Lancashire and Yorkshire Railways, rendered vacant by the death of Mr. J. A. Ferris, has been filled by the appointment of Mr. W. Govan, chief canvasser for the Belfast and Fleetwood service.

* * *

ON Sunday, August 8th, the Gretna branch was closed for traffic until further notice. This line runs from Longtown, on the Edinburgh and Carlisle main line (Waverley route), to Gretna.

* * *

THE Directors of the Central Argentine Railway Company have published a handsome booklet giving the names of 312 members of the staff now serving with His Majesty's Forces.

* * *

A READER from Inverkeithing, Fifeshire, directs attention to the fact that the North British Railway have added five more 4-4-0 engines fitted with the Robinson superheater, but otherwise of the "Scott" class, their names and numbers being:—424 *Lady Rowena*, 425 *Kettledrummle*, 426 *Norna*, 427 *Lord Glenvarloch*, 428 *Adam Woodcock*. He also mentions that on the Great North of Scotland Railway engines are now being painted black instead of green as hitherto.

* * *

Two London, Brighton and South Coast Railway men have received honours and decorations for conspicuous bravery and gallantry, as follows: T. Kemp, Carriage Cleaner, Carriage and Wagon Department, No. 27701, Bombardier, R.F.A., awarded D.C.M. for conspicuous bravery in serving his gun; J. J. Ingram, Assistant Fitter, Electrical Department, No. 4641, Corporal, Coldstream Guards, awarded D.C.M. for conspicuous gallantry in the trenches (subsequently killed in action).

* * *

OWING to the enlistment of railwaymen and the consequent shortage of staff, the following stations on the North Eastern Railway will be temporarily closed on and after Monday, September 20th, 1915:—Benton Square, Cayton, Fyling Hall, Hessay, Newby Wiske, and Smardale. Newport station has been closed since August 8th.

* * *

THE Lancashire and Yorkshire Railway have just issued their syllabus of lantern lectures for use during the coming season. The series comprise ten lectures, which deal with Belgium and the popular holiday and pleasure resorts in Lancashire and Yorkshire, Wales, Ireland and the Isle of Man. In view of the state of affairs in Belgium the lecture dealing with that country is especially interesting at the present time. Full particulars of the conditions of loan may be obtained from Mr. A. Watson, Superintendent of the Line, Manchester.

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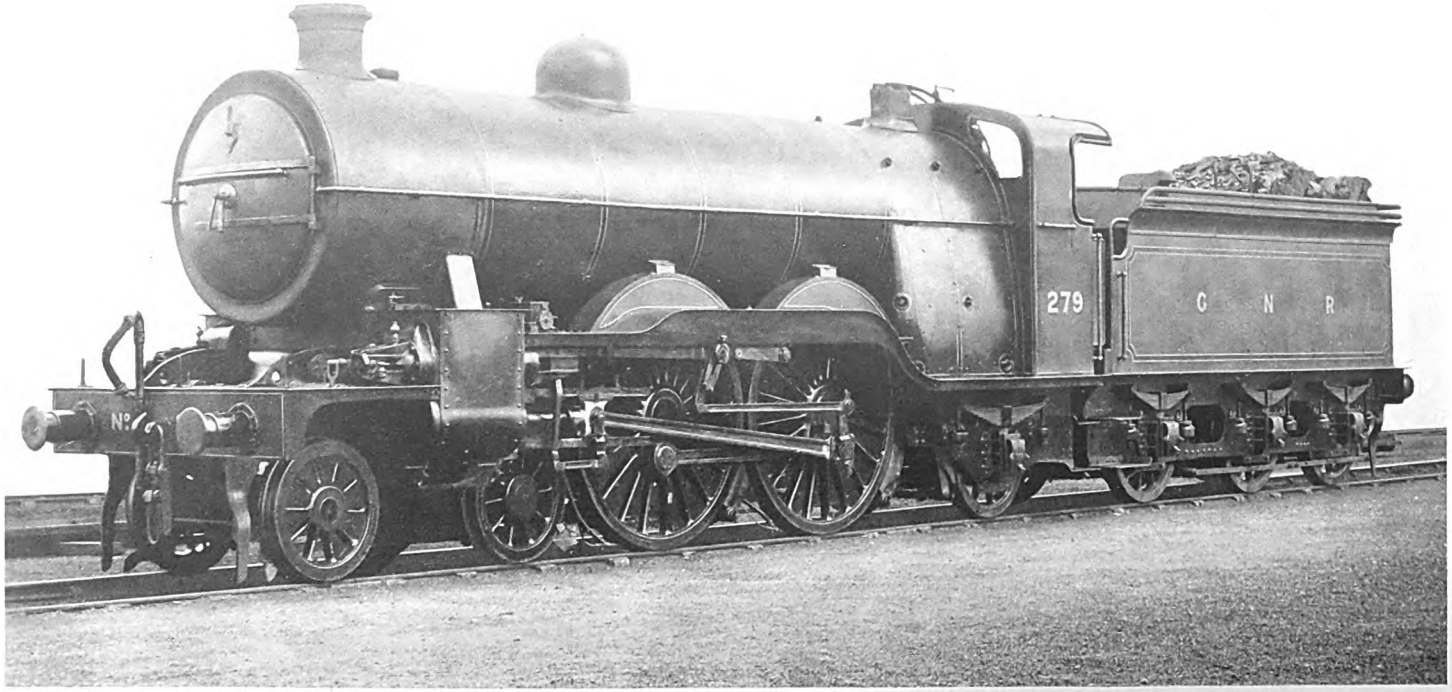

"Atlantic" Locomotive No. 279, Great Northern Railway.

Originally designed by Mr. H. A. Ivatt, and now rebuilt by Mr. H. N. Gresley, Locomotive Engineer, with four simple cylinders, built-up crank axle, Walschaert valve-gear and Robinson superheater.

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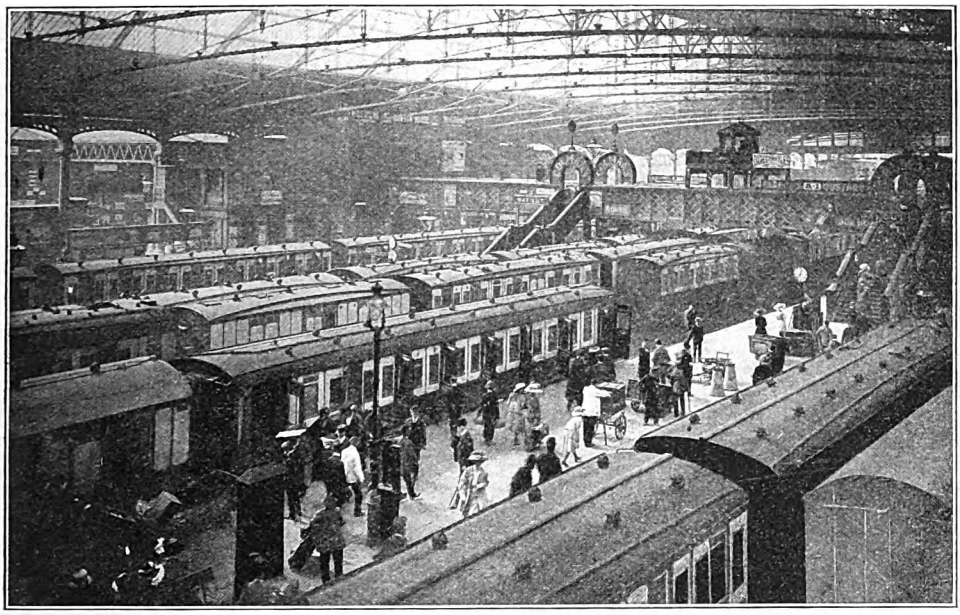

GENERAL VIEW IN NEW STREET STATION: LONDON AND NORTH WESTERN SIDE.

Notable Railway Stations and their Traffic.

NEW STREET, BIRMINGHAM.

By J. F. GAIRNS.

APART from a few of the big terminal stations where an enormous suburban traffic is concentrated—and there are not many which need to be excluded even on this ground—New Street, Birmingham, ranks as one of the busiest stations in the United Kingdom, both in respect of numbers of trains, and in regard to the numbers of passengers who arrive at, or depart from, its platforms in the course of twenty-four hours. Indeed, it is claimed, with a considerable degree of justification, that both the London and North Western and the Midland Companies, who divide the New Street station between them, deal there with traffic at least equal to that of any two stations elsewhere on either system. Be this as it may, the fact remains that an average number of trains in and out during an ordinary week-day is 770, increased at times to a thousand or more, while some 20 millions of passengers arrive or depart in the course of twelve months, figures which can be exceeded or equalled by a very few other stations, and those usually of a terminal character.

In the RAILWAY MAGAZINE for April, 1900, Mr. S. M. Philp described New Street, dealing with its history, characteristics, traffic and personnel; but while the station has altered little in the interim, the past fifteen years have produced great changes in other ways, so that no apology need be made for including this great centre of traffic for a second time as a "Notable Railway Station."

There is no need to repeat the history of New Street; but certain facts must be reviewed in order to understand how it came to be made a joint station, notwithstanding that it has always been, and still is, a freehold of the London and North Western Railway Company.

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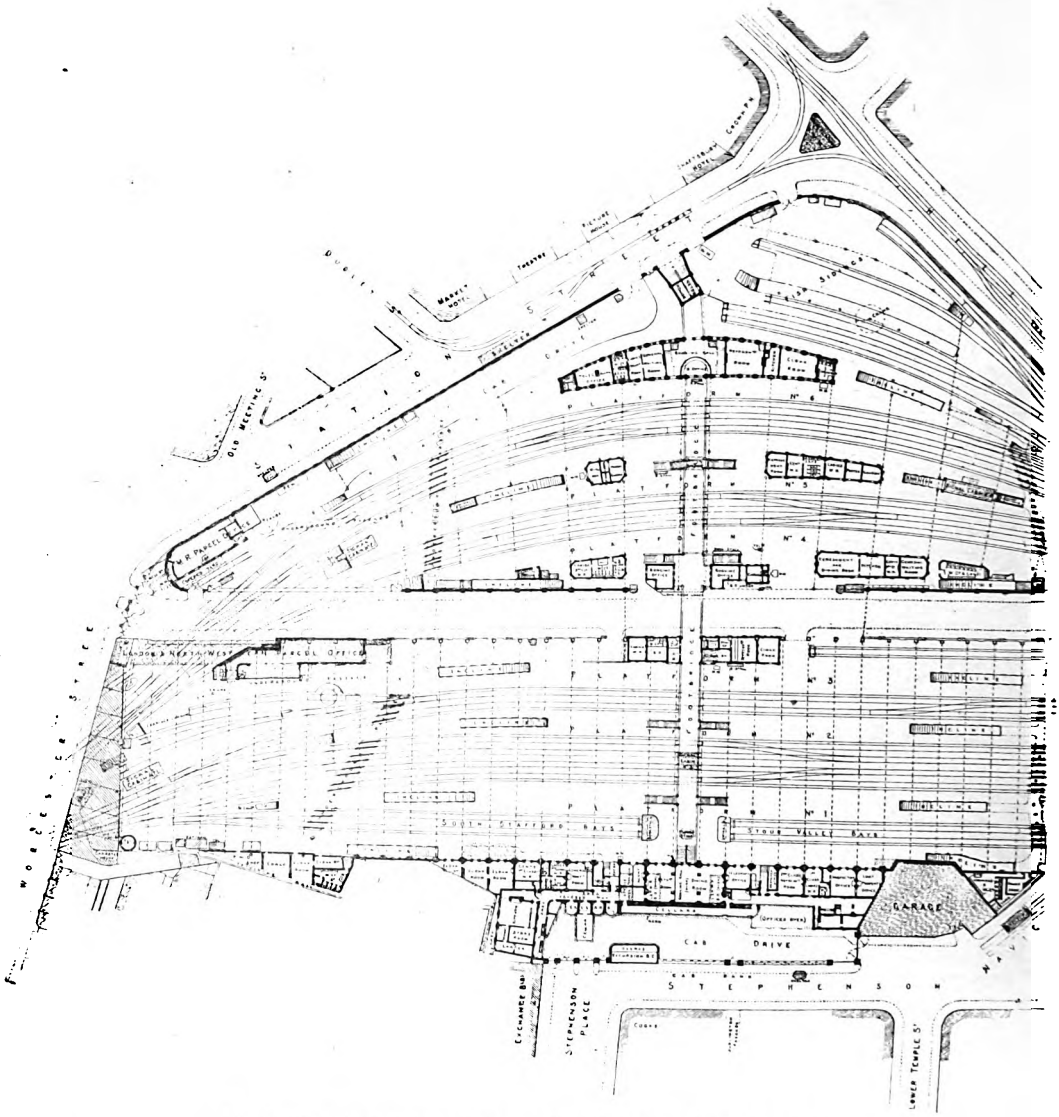

PLAN OF NEW STREET STATION (*continued on opposite page*).

At first, in the days of the London and Birmingham Railway, the terminus in the "Hardware" capital was at Curzon Street, now, and for many years past, the chief London and North Western Railway goods depôt in the City of Birmingham. But the construction of the Stour Valley line, authorised in 1846, included a proposed central station in Birmingham, fronting Navigation Street, by which name the station was at first known. In due course this was opened (in 1847), soon after taking the name by which it is familiar all the world over.

Although included in the Stour Valley scheme, there was, however, a complicating factor, in the form of the Bristol and Birmingham Railway, promoted by Acts of 1828 and 1836, of which company, as a result of certain developments, the London and Birmingham, and Midland Companies had obtained a degree of control by guaranteeing a fixed dividend on the capital. In 1846 the Midland Railway obtained powers to absorb the Bristol and Birmingham Company, and an arrangement was made, in view of the London and Birmingham Company's share in the guarantee referred

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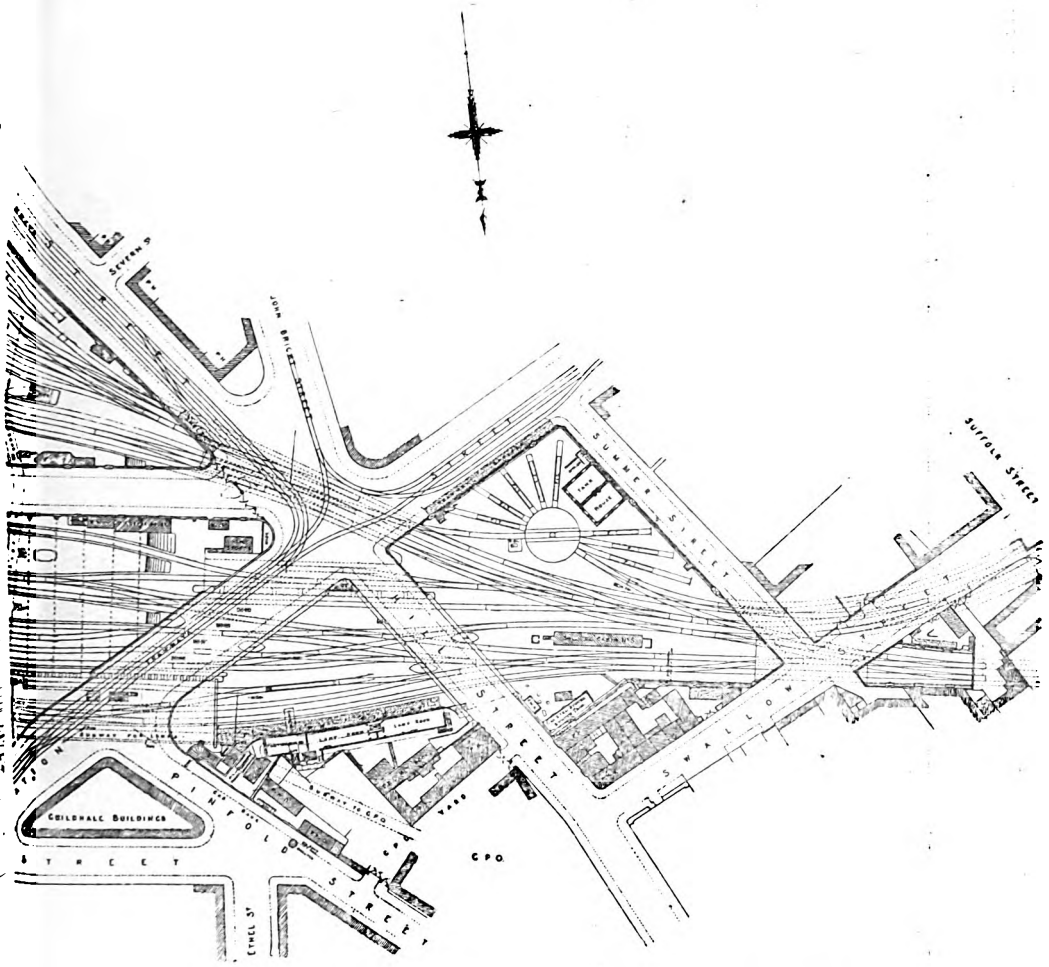

PLAN OF NEW STREET STATION (*continued from opposite page*).

to, whereby the latter was released from this obligation, on the understanding that the Midland Company should have the use of New Street station, subject to a nominal rent and a contribution towards the working expenses.

This arrangement continued for many years, for the station was built with a view to a considerable amount of traffic—according to the estimates which would be current in the 'forties and 'fifties. It consisted, in fact, of the section now devoted exclusively to London and North Western trains, so that it ranked as a large station, according to the ideas of those days. In due course, however, it became necessary to enlarge the station, and as it was manifestly unfair to expect the owning company to bear the whole of the expense involved, especially as the growth of traffic applied to both parties, a bargain was made whereby the two companies shared the cost of enlargement. This work was commenced in 1882 and completed in 1885. For some time the station continued to be used generally by either company's trains, but a few years later it was found preferable to divide the traffic as at present, the Midland Railway

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taking possession of the new portion as a matter of convenience, and the London and North Western Railway the old, though either is entitled to the use of the whole or any part of the station.

In the course of enlargement the thoroughfare formerly known as Great Queen Street became the central carriage drive, with the new portion of the station beyond it. This completed the station, almost as it is to-day, but increasing traffic created other difficulties, the most serious being the congested approaches in view of the numerous routes converging upon New Street from both directions within two or three miles on either side; and with important junctions about every quarter of a mile or so. Widenings were therefore undertaken with a view to giving the two sections of the station independent approaches. Here again the Midland Company contributed to the heavy expense, and in compensation it was agreed that instead of the Midland being tenants only, they should become jointly responsible for the station and have a joint share in its management. Therefore, since 1897, New Street, though still in the exclusive ownership of the London and North Western Railway, and maintained by them as far as repairs, etc., are concerned, has been, to all intents and purposes, a joint station, managed by a joint committee, and worked by a joint staff under a joint station superintendenc. The widenings referred to were completed and brought into use in May, 1896, sinse which date traffic of the two companies hat been worked independently, there being little communication between the two sections of the station except for interchange traffic, each section having independent lines serving it in both directions.

The staff of New Street station therefore consists mainly of joint employés, with a certain number engaged solely in the service of one or other of the two companies concerned. The latter are chiefly men located at New Street for convenience, or concerned only with one company's business, the operative staff being joint. The station superintendent is appointed alternately by the London and North Western and Midland Companies, the present occupant of that position being Mr. W. Cresswell, a Midland nominee. In view of the importance of New Street, the position of station superintendent calls for considerable capabilities, and Mr. Cresswell had a wide experience before coming to New Street in 1908. He entered Midland service at Clay Cross some 28 years ago. For some time he was employed at St. Pancras station, but it was in the Birmingham district that he had most experience first at Selly Oak station, for a time on the staff at New Street, and as stationmaster at Castle Bromwich. He was then appointed an assistant traffic inspector at Derby, thence becoming an assistant controller at the Saltley depôt. Returning to Derby, he was engaged for a time on special duties under the General Superintendent, Mr. Cecil W. Paget; and when Mr. J. Squires, the previous station superintendent at New Street, retired from London and North Western service, Mr. Cresswell was appointed as Midland nominee to succeed him.

Under Mr. Cresswell the responsibility for the management of the station rests with Mr. Hartland as his chief assistant, with Messrs. Davis and Masters as other assistants, at least one, if not more, of these gentlemen always being on the premises. The ordinary clerical staff numbers 13, with about 220 members of the uniform staff. The latter include inspectors, foremen, foreman collectors, collectors, policemen, excess-men, cloak-room attendants, waiting-room attendants, lavatory attendants, lost-property-office men, horse-box men, shunters and luggage porters, together with 26 signalmen for manning the six signal cabins by which traffic in the station is controlled. An equal number of men are qualified to take the place of the 26 signalmen regularly engaged. There are usually from 20 to 30 supernumeraries employed, according to requirements.

These figures relate to the joint staff only, but as each company has certain phases of its business which require attention on an individual basis there are several officials who are either London and North Western or Midland employés, besides nearly 240 men of various grades. On the Midland side Mr. H. P. Verrinder, District Passenger Agent, has oversight of the Midland booking and parcels offices, and general passenger train traffic in Birmingham and district. He is responsible for all work at New Street, other than the operation of trains, affecting the Midland Company only, combining functions covered by individual officers appointed on the London and North Western side, though he has, of course, a number of assistants and foremen for various purposes. Mr. Verrinder may be described, indeed, as District Passenger Agent, Station

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Agent, Parcels Agent, District Rolling Stock Controller, District Cashier, etc.

In the case of the London and North Western Railway arrangements are somewhat different. Mr. R. T. Morcom is District Superintendent for the whole of the Birmingham area, extending from Rugby to Stafford, Dudley, Leamington Spa, Derby, etc., and the various branches. He has occupied that position for nearly 6½ years. Previously he was at Northampton as District Superintendent having oversight of the eastern lines, other appointments being as Outdoor Assistant at Euston, Assistant Superintendent of the Lancaster and Carlisle section, and then of the Liverpool district. His office at New Street is located on the Midland side of the station, but actually he is only concerned with the working of London and North Western traffic to specified junctions and signal boxes outside New Street station, which mark the limits of Mr. Cresswell's responsibility.

Mr. Hudson is London and North Western agent, though his position is different from that of Mr. Verrinder, notwithstanding his similar official title. He is responsible for the provision of rolling stock and guards for all trains required, and for otherwise meeting traffic demands. He also has charge of the carriage sheds at Vauxhall and Monument Lane, and of the storage sidings at Soho, Adderley Park and Shenstone. He is assisted by 2 traffic inspectors, 2 foremen, 2 clerks, 31 guards, 7 coach shunters, 2 train recorders and 3 despatch men.

The London and North Western Railway booking offices are under the direction of Mr. Meech, and the parcels under Mr. Millington, both these gentlemen being responsible to Mr. Morcom. As manager of the Queen's Hotel adjoining the station, one of the well-known and deservedly popular hotels owned and maintained by the London and North Western Railway, Mr. Burleigh (since placed in charge of the Euston hotels) has also charge of refreshment rooms and dining rooms on the London and North Western side of the station, while the Midland Company control those on Nos. 4, 5 and 6 platforms, with dining rooms on Nos. 4 and 6.

While Mr. Hudson may be described as rolling stock controller for traffic purposes, the carriage department is represented by Mr. Newbury. He has offices at New Street —at the end of the Stour Valley arrival platform to be referred to—but his oversight extends also to the workshops attached to the Vauxhall and Monument Lane carriage depôts, with control of these depôts as regards the maintenance of all passenger traffic rolling stock attached to his district. Adjacent to his office is a stores for carriage fittings and details. He has about 170 men under his direction, most of them at the carriage depôts, but a few at New Street. These latter are concerned with examining and wheel-tapping, axle-box oiling, gas-charging, maintenance of electric light, etc. Attached to the Birmingham carriage depôts and sidings are between 700 and 800 vehicles, but Mr. Newbury also has oversight of coaches from other districts while within his area, and attends to small repairs or the like which they may require to complete their duties.

A plan of New Street station is reproduced on pages 334 and 335, and from this it will be seen that it provides 15 platform faces, and as the eight through platform lines will each accommodate two trains, unless of great length, no fewer than 23 trains can be in the station at once if required. A large majority of the trains are advertised publicly as terminating at, or starting from, New Street, but at least 50 per cent. of them come in as one train and depart as another, continuing out of the station at the opposite end without detaching the engine. Therefore on several lines it is usual to bring one train up behind another, especially at busy periods.

At present the platforms are known as Nos. 1, 2, 3, 4, 5 and 6, but a better system is shortly to be introduced, to avoid the necessity for differentiating the two sides of the islands and the various bay lines. Nos. 1, 2 and 3 constitute the old station, now used for London and North Western trains. The roof over this portion is in one span of 210 ft., extending the length of the station rendering it one of the most remarkable erections of its kind. At the "north" end—geographically the west end—Navigation Street crosses the station area obliquely, and the angular space between the walls of the bridge carrying this thoroughfare at the end of the main roof span is covered by ridge and furrow glazing supported on a system of transverse girders.

While the old roof span is substantially rectangular, that of the new portion is sharply curved. It matches the old roof, but is in two separate spans with ridge and furrow transverse glazing filling the spaces between the central drive and the

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or 8,000, or even more at special periods. It is a wide structure, 20 ft. between parapets, but it is a common occurrence for it to present the appearance shown on page 344, the photograph from which this view is reproduced having been taken on an ordinary day in February, a few years ago.

On the New Street side the footbridge is approached through the booking hall at that end, immediately alongside the Queen's Hotel, and thence continues right across the station to stairways leading into another booking hall which opens on to the courtyard adjacent to Station Street. Each platform is served by a stairway on either side of the footbridge. To Nos. 1, 2, 4 and 5 these are open, but on No. 3 there is a block of buildings in which the stairways are enclosed, as also on No. 6 where the footbridge leads into the booking hall as already mentioned. Over No. 3 platform are tobacconist's and fruiterer's shops on footbridge level, and the Station Superintendent's offices. A little further along, by the stairways leading to No. 4 platform, are local booking offices, one on each side, respectively London and North Western and Midland. These two groups of buildings are on either side of the central drive, and on platform level are booking offices, cloak room, refreshment rooms, etc., these facing respectively Nos. 3 and 4 platforms, and applying to the business of the railway whose trains use the adjoining platform.

The block of buildings on No. 6 platform includes the offices of the London and North Western District Superintendent—Mr. R. T. Morcom—and his staff, with booking hall and station offices for Midland traffic below.

No 2 platform is peculiar—owing to its narrow width—in that it is the only one without buildings of any kind. Every other platform has refreshment rooms—Nos. 1, 4 and 6 have dining rooms also—cloak rooms, parcels offices, waiting rooms, and other conveniences, while Nos. 3, 4 and 6 have booking offices on platform level. Altogether there are eight booking offices in the station. On No. 5 platform in one of the two blocks of buildings there, Mr. Verrinder has his offices as Midland Agent.

In large measure each platform face at New Street is reserved for trains for particular destinations or routes, and the footbridge is spanned at each end by a large notice specifying the platforms usual for the respective trains. At the head of each stairway is posted a list of trains departing from the platform concerned, and in conjunction with other notices and directing pointers, there is not much opportunity for anyone to go astray or to be unable to find his train.

Traffic is controlled by six signal cabins. No. 5 is the largest and is placed just beyond the platforms at the "north" (west) end. It has 152 levers, and controls both London and North Western and Midland traffic, the latter beyond station limits only, as station work at that end comes under the control of No. 4 box (73 levers) which is placed near that end of No. 5 platform. No. 3 cabin, with 24 levers, occupies a unique position, as it is carried by a bridge spanning the footbridge between Nos. 1 and 2 platforms. Its levers are outside the cabin proper, though, of course, sheltered by the roof of the station, and the men have thus an exceptionally fine view of all London and North Western lines with which only are they concerned. No. 1 (59 levers) controls the London and North Western Railway traffic at the "south" (east) end of the station, and is placed near the London and North Western Railway parcels office at

MR. NEWBURY.
Carriage Department.

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that end of the station. No. 2 (75 levers) similarly controls Midland traffic at that end, being located on No. 5 platform, which thus has a signal box towards each end. No. 6 Box (17 levers) is under Navigation Street bridge in the centre of Stour Valley bays, and controls the shunting and platforming of trains on the bay lines.

No. 5 controls transverse traffic between the two portions of the station at the "north" end, while Nos. 1 and 2 require to co-operate for similar work at the opposite end. Most transfer work is, however, done at the north end, where the connections are more suitable, the south end being adapted rather for running trains through from the London and North Western lines to the Midland or *vice versa*. The station is divided midway by signals carried upon or adjacent to the footbridge, so that admission to the station only permits a train to go thus far unless the midway signals are lowered.

No. 1 is the most complicated platform owing to the existence of two bays at either end, with a separate "Stour Valley Arrival" platform, the only one whose location is at all mystifying to the stranger. The through face of No. 1 platform is used by the famous two-hour expresses and other south-bound trains, and for up main line traffic generally. The two "South Stafford Bays" accommodate local trains for Coventry and Leamington. The "Stour Valley" bays similarly deal with many of the Walsall and other local trains, the peculiar feature being that the outer of these bays is continued outside the limits of the station proper, as the Stour Valley Arrival platform, where arriving trains unload their passengers. A separate exit is afforded from this platform to Pinfold Street.

"GOING NORTH" FROM NEW STREET IN MID-VICTORIAN TIMES.
From *The Illustrated Midland News*, August 13th, 1870.

The Queen's Hotel at present bounds the station only for about half its length, some of its rooms overlooking the whole of the station. It is one of the largest and is probably the most highly-esteemed hotel in Birmingham, and is now being extended for the remaining length of the station, alongside the Stour Valley bays. When completed the accommodation will be nearly double that now available. The main floor of the hotel is on road level, the principal entrance opening on to the London and North Western courtyard, though it can also be reached from the booking hall at this end of

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the footbridge, or directly from the circulating area of No. 1 platform. Below the hotel buildings are London and North Western Railway cloak rooms and parcels offices, with refreshment rooms, dining rooms etc., though some of these will be re-located and modernised in connection with the hotel enlargement works.

As already mentioned, No. 2 platform is the narrowest of all, and is reserved as far as possible for purely local traffic, one side receiving up trains, and the other down trains.

No. 3 is the principal down London and North Western Railway platform, and here arrive the expresses from London and many of the local trains from the Coventry and Leamington direction, while expresses for Wolverhampton, Stafford, Crewe, Liverpool, Manchester, North Wales, Blackpool and Scotland usually depart here.

At the "North" end of this platform is a single bay line, used for miscellaneous traffic and occasionally for stabling vehicles ready to meet a demand, or sets of coaches not required for a time. By the staff it is generally referred to as the "Coffee Bay," owing to the fact that there is now a coffee tavern for the benefit of the staff, with Post Office room, porters' rooms and other miscellaneous station offices below and adjacent.

The "South" end of No. 3 platform leads to several "stub" lines used for parcel vans, horse boxes, carriage trucks and milk vans, the London and North Western main parcels office being placed here so as to utilise the area left vacant by the differing curvatures of the London and North Western and Midland approaches to the platforms.

"GOING NORTH" FROM NEW STREET IN THE TWENTIETH CENTURY.
A holiday crowd waiting for a Llandudno train on No. 3 platform.

No. 4 platform has only one face, and receives most of the principal Midland trains from Bristol and Bath for Derby and the North. No. 5 is double-sided, one face amplifying No. 4 platform for traffic towards Derby, while the other duplicates No. 6 for traffic towards Bath and Bristol. It is largely used for suburban trains, but also accommodates many long-distance trains. At the "South" end of No. 5 platform is a short dock.

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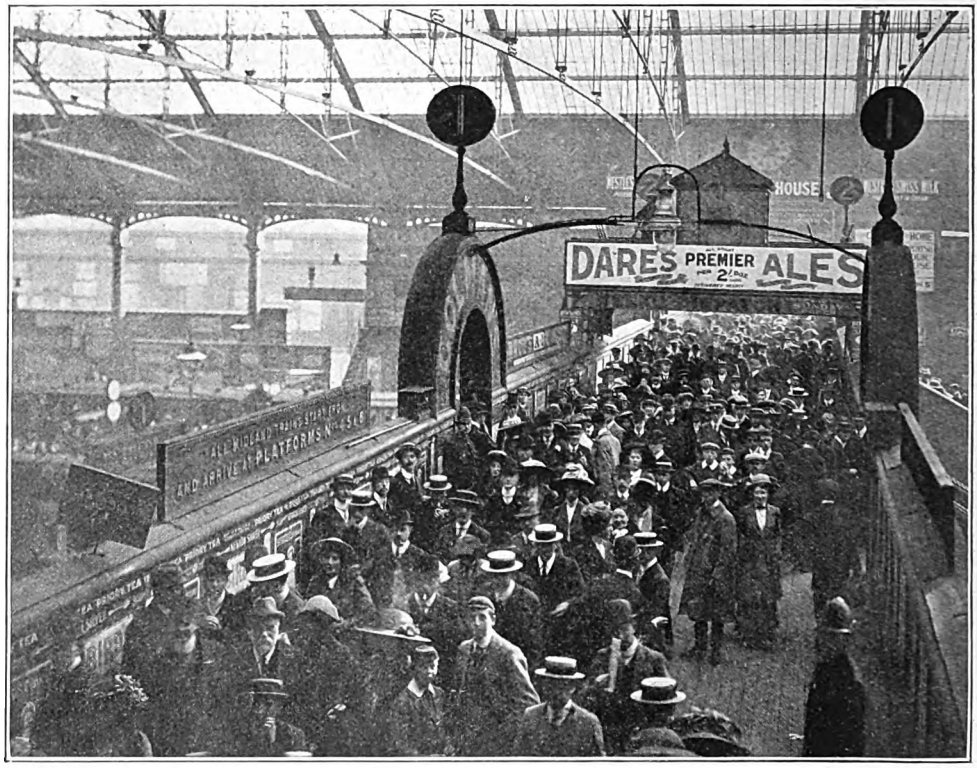
No. 6 is the principal west-bound platform for Midland traffic. At one end this has a bay platform from which many of the suburban trains depart. Beyond this bay is the fish and milk yard, with horse-box and carriage loading banks beyond, used by both companies, but ordinary Midland parcels traffic is dealt with at a dock formed at the "South" end of the station adjoining No. 6 through line.

Although the writer has endeavoured to indicate the general allocation of traffic, such remarks must be taken with reserve, seeing that there are so many alternative routes in the Birmingham area that trains can go almost anywhere from any part of the station and in either direction. In fact, both companies operate at least one true "roundabout" service, and many others are possible. Even express trains can leave New Street at opposite ends for the same destinations, and a few do so, though such facilities are mainly reserved for trains of local importance. For example, it is possible for three trains to leave simultaneously for Walsall, two from the North Western side, and one from the Midland, while several other possibilities are available, many being utilised in order to meet the requirements of the various districts around central Birmingham.

As showing the complications of traffic dealt with at New Street it will be interesting to review an hour's departures, the period between 5 and 6 p.m. (not on Saturday) being selected as it includes ample provision for homeward-bound suburban traffic.



A SCENE ON THE FAMOUS FOOTBRIDGE.

	Time.	*Destination.*	*Platform.*
L.N.W.	5.0	Stafford (Thursdays only)	3 Bay.
L.N.W.	5.0	London	1 Main Up.
MID.	5.0	Redditch, Evesham and Ashchurch (*viâ* South-West Suburban line)	5 Down.
L.N.W.	5.5	Sutton Coldfield and Four Oaks	2 Up.*
L.N.W.	5.5	Wolverhampton ..	2 Up.*
MID.	5.6	King's Norton (*viâ* Camp Hill)	4 Up.
L.N.W.	5.8	Hampton ..	1 (2 South Stafford Bay).

* These two trains leave the same platform line at the same time, but in opposite directions.

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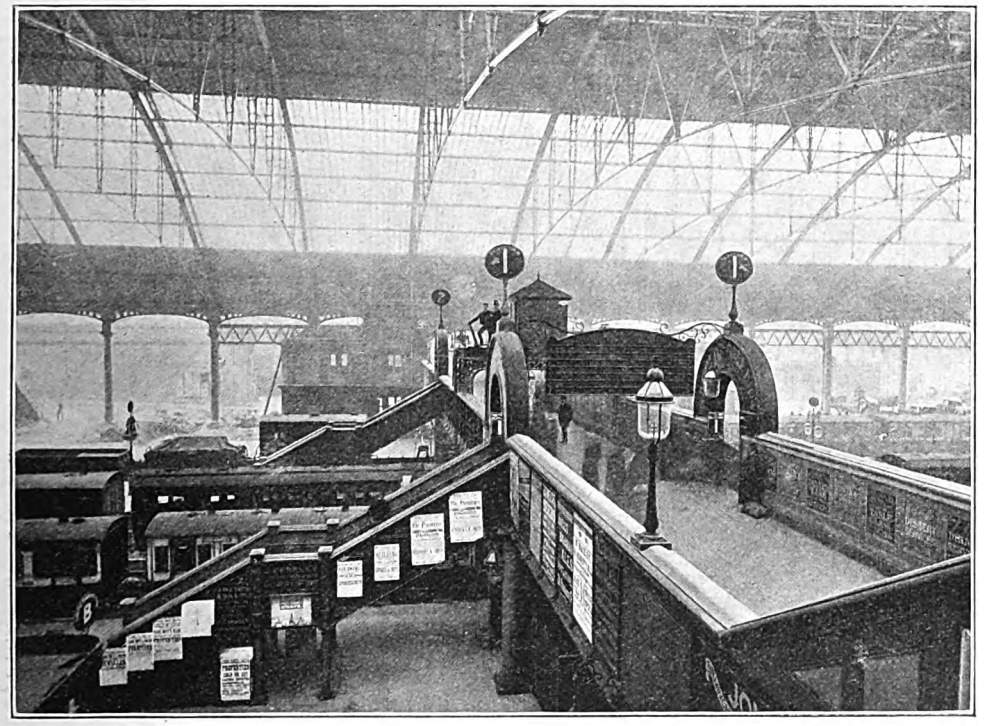
	Time.	Destination.	Platform.
L.N.W.	5.12	Empties of train from North in at 5.5 ..	1 Main Up
MID.	5.14	Nuneaton, Leicester, London, King's Lynn	5 Up.
MID.	5.15	Worcester, Ashchurch, Malvern and Bristol slow	6 Down.
L.N.W.	5.15	Harborne ..	1 (2 Stour Valley Bay).
L.N.W.	5.20	Sutton Coldfield and Four Oaks	2 Up.
MID.	5.20	King's Norton (*viâ* West Suburban line) ..	6 Bay.
L.N.W.	5.25	Wolverhampton ..	3 Down.
MID.	5.40	Cheltenham, Gloucester and Bristol	6 Down.
MID.	5.42	Burton, Derby, Bradford and N.E. line ..	4 Up.
L.N.W.	5.43	Coventry and Leamington	1 Main Up.
MID.	5.48	Tamworth, Burton and N.E. line. (Mondays, Fridays and Saturdays only)	4 Up.
L.N.W.	5.50	Walsall (*viâ* Aston) ..	1 Main Up.
L.N.W.	5.50	Liverpool, Leeds and Manchester	3 Down.
MID.	5.50	Gloucester slow ..	5 Down.



ANOTHER VIEW OF THE FOOTBRIDGE (ON A SUNDAY MORNING).

L.N.W.	5.30	Walsall, Rugeley, Lichfield (*viâ* Soho Road)	2 Down.
L.N.W.	5.30	Coventry and London	1 (1 South Stafford Bay).
MID.	5.30	Walsall and Wolverhampton	4 Up.
L.N.W.	5.35	Harborne ..	1 (1 Stour Valley Bay).
L.N.W.	5.37	Sutton Coldfield ..	2 Up.
MID.	5.38	Circle train outward, *viâ* Camp Hill ..	5 Up.
L.N.W.	5.40	Walsall and Wolverhampton (*viâ* Soho Road)	2 Down.
L.N.W.	5.40	Leamington ...	1 (2 South Stafford Bay).
MID.	5.55	Tamworth and Nuneaton slow	5 Up.
L.N.W.	6.0	Harborne ..	1 (1 Stour Valley Bay).
L.N.W.	6.0	Sutton Coldfield, Lichfield, Burton, Derby	1 (1 South Stafford Bay).

Arrivals are similarly comprehensive, but as indicating the volume of suburban traffic dealt with at New Street, it may be mentioned that between 8 and 9 a.m. no fewer than 28 trains of local importance arrive (18 London and North Western Railway, 10 Midland Railway), while a further 30 trains (19 London and North Western Railway, 11

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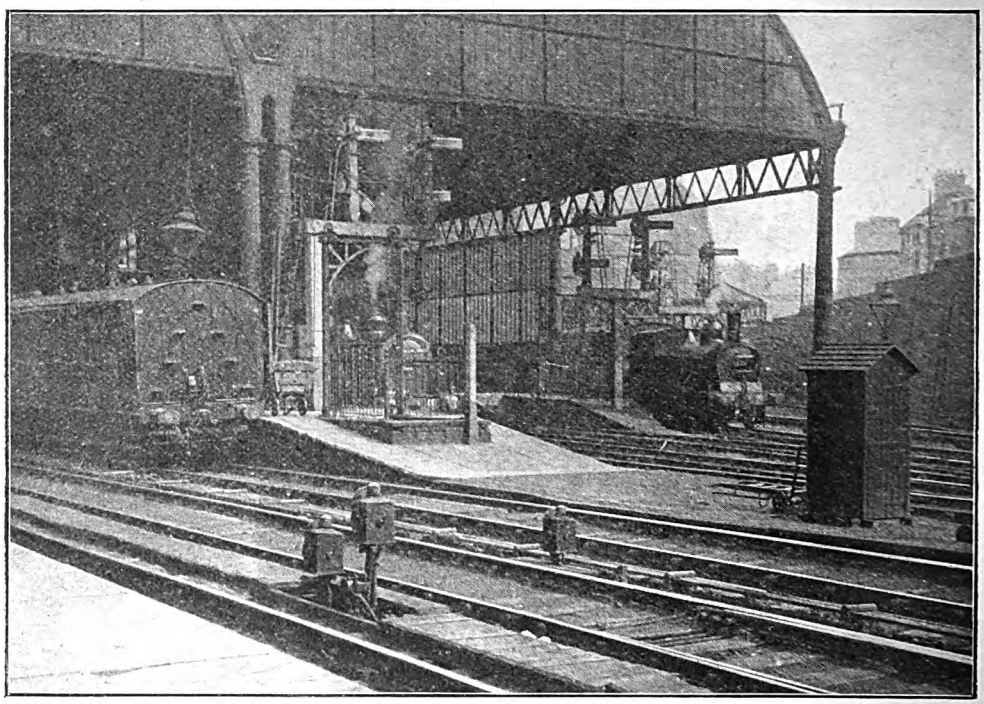
Midland Railway) bring corresponding passengers after 9 a.m. and before 10 a.m. has struck. And yet, as train after train arrives, unloading its passengers and proceeding away—almost invariably continuing in the same direction—for another destination or empty, matters proceed as evenly and smoothly as if there were only a few trains and perhaps a hundred or so detraining passengers instead of the thousands who so quickly disperse for business.

Although trains are not usually worked on the engine bay principle, one engine bringing a train in and another taking it out as usual at large termini, the carriage lines between Nos. 1 and 2, 4 and 5, and 5 and 6 platforms enable engines to be attached at the rear end when required, or trains which do not proceed onwards at once to be dealt with. In the case of the Stour Valley arrival platform the engine of an arriving train usually uncouples and runs ahead to another road, and the train brakes are then released to allow the empty coaches to gravitate down to the desired departure road. The other Stour Valley bay is largely used by motor trains which do not require detachment and reattachment of the locomotive. Otherwise there are plenty of crossover roads and several spurs where engines or coaches can be placed for meeting the shunting and other requirements of the station, so that it is not a complicated business to deal with the few terminating trains which may require transfer to one or other of the departure bays, or the attachment of a fresh locomotive before they can leave again.

Local traffic is largely operated by both companies by means of four-bogie sets of coaches, but at business periods many trains require strengthening, and on the heaviest traffic, such as that on the Sutton Coldfield and Harborne routes, two such sets are often operated together. Many motor-trains also work into and out of New Street on the London and North Western side. For the heavier suburban trains London and North Western Railway 4–4–2 and a few 4–6–2 tanks are employed, while the Midland uses several 0–6–4 tank engines. Otherwise the London and North Western Railway 0–6–2 and 2–4–2 tank engines are principally in evidence, with the ordinary 0–4–4 tank engines on the Midland side.

The busiest Midland routes are those to King's Norton *viâ* Camp Hill and *viâ* Selly Oak (West Suburban Line), and by other routes to Barnt Green.



ON THE MIDLAND SIDE, WEST END.

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PLATFORMS 2 AND 3 SHOWING THE "COFFEE BAY."

Holiday periods the scene at New Street can only be appreciated by actual experience, and it is by no means unusual for a hundred or more extra trains to be dealt with at such times. In normal times there are also the through coaches for the Harwich route to the Continent.

On the Midland side there are the expresses west to Cheltenham, Gloucester, Bath and Bristol, with the Bournemouth traffic *viâ* the Somerset and Dorset Joint Railway as a very big factor. Northward the expresses run to Derby and thence to Liverpool, Manchester, Leeds, Bradford, Scotland and York, for the North Eastern Line, with a number of through trains to King's Lynn and the Midland and Great Northern Joint Railway for Cromer, Yarmouth and Lowestoft.

All platforms are connected for luggage transfer by two subways with inclined approaches, and one of these subways is continued to give private access to the General Post Office building.

With so large a staff it almost goes without saying that provision is made for the welfare of men employed at New Street. For the uniform staff the coffee tavern and rest rooms adjoining the "Coffee Bay" are provided, operated as a "limited liability company" by a committee appointed for the purpose, where meals are supplied at very reasonable prices. Mr. F. Butter, Chief Train Clerk to Mr. Morcom, is secretary of the Refreshment Committee. In addition there is an Institute and Reading Room, adjacent to No. 1 Stour Bay platform, where concerts and entertainments, picnic, football and cricket clubs, flower shows and whist drives take place. Mr. Horton is acting secretary of the Institute.

Fifteen years ago in these pages Mr. Phillp made out an incontrovertible claim for ranking New Street not only as a "Notable Railway Station," but as one of the *most* notable stations in the United Kingdom, if not in the world. To-day, notwithstanding the wonderful tramway system which ministers to the transportation needs of Birmingham and the introduction of motor omnibuses on a large scale, New Street deals with nearly 100 more regular trains daily and some thousands more passengers. Moreover, it must be remembered that quite a number of adjacent stations—Aston, Vauxhall, Stechford, Soho Road, Saltley, etc.—if not actually adjacent to the commercial thoroughfares of Birmingham, are convenient for many manufacturing areas, so that numerous suburban trains convey a large volume of traffic which does not come into New Street station itself. But for main line traffic New Street station *is* Birmingham to travellers by two out of the three railways serving the hardware capital, and the opinion may be expressed that it affords no mean introduction to this the third largest city in the Kingdom.

Altogether nearly 1,200 men and women are employed at the station. It is also claimed that New Street station takes more excess fares, excess luggage charges and cloak room fees than any other station in the United Kingdom.

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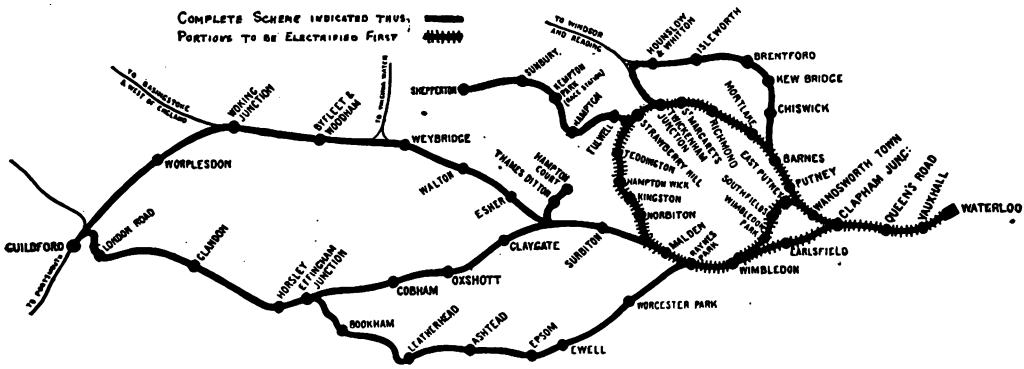
A Great Electrification Undertaking: Equipment of the London & South Western Suburban System.

IN January, 1913, particulars were given of the extensive scheme of electrical equipment approved of by the directors of the London and South Western Railway; and in December of the same year we were able to announce that the work of installation had been commenced. Since then various references have indicated that progress was being made with the undertaking. In fact, work was proceeded with somewhat rapidly, and notwithstanding the magnitude of the scheme there is no doubt that electrical working would have been inaugurated some months ago had it not been for the inevitable delays due to the war. As we go to press we are informed that electric trains will commence working the Waterloo-Wimbledon route *viâ* East Putney on Monday, October 25th, giving a 20-minute service and an acceleration of 7 minutes. The Kingston "roundabout" route will follow in the course of a week or two.

The scheme as a whole is a most comprehensive one, including, as shown on the map reproduced, the Kingston "roundabout" route, the Southfields route to Wimbledon, the Brentford loop, the main line to Woking and thence to Guildford, the Oxshott and Epsom routes to Effingham Junction and thence to Guildford, and the Shepperton and Hampton Court branches.

The trains are equipped for multiple-unit working, and for convenience in handling, are made up of three-coach units, consisting of two motor coaches with a trailer coach close-coupled between them. Original compartment coaches with side doors have been utilised, the necessary alterations being made to fit them for the electrical apparatus. These three-coach units are intended to be permanently coupled, and form convenient and handy units for traffic. It is intended to use one or two of these units per train to form three or six-coach trains, depending upon traffic requirements.



PLAN OF LINES CONCERNED IN LONDON AND SOUTH WESTERN RAILWAY ELECTRIFICATION WORKS.

Each unit is equipped with four 275 h.p. 590 r.p.m. motors, geared 21/59 on standard 42½ in. driving wheels; these motors are arranged in pairs on the bogies underneath the driving compartments at opposite ends of the unit. All the electric control gear is placed in these compartments, each pair of motors being controlled by its own set of controlled gear. The arrangement of the control gear in the driver's cab was decided upon as preferable to having it underneath the coach on account of the greater ease of

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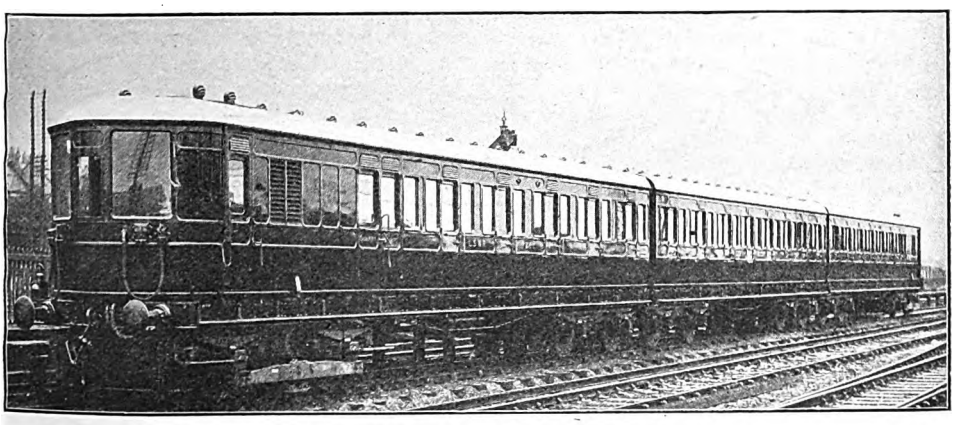
motors with all resistance in circuit; the second position brings the automatic relay into operation, and the resistances are cut out of circuit step by step until full series is obtained; the third position connects the motors in parallel, the well-known bridge connection being used in passing from series to parallel; the fourth position brings the automatic relay into operation again, cutting out the resistance step by step until full parallel is obtained. It is unnecessary to pause on each notch of the controller until the corresponding motor connections are completed, but the handle may be moved directly to either the series or parallel positions, when the control apparatus automatically notches up, step by step until the position is reached, corresponding to the particular notch on which the handle is placed.



THREE-COACH UNIT ELECTRIC TRAIN.

The starting current, and, therefore, the rate of acceleration, may be adjusted by means of the setting of the automatic relay; this relay consists of three coils, two of which have moveable plungers fitted with copper discs for bridging contacts in the control circuit, the three coils having a common magnetic circuit. The two coils, which have moveable plungers, are connected in the control circuit, and the third coil is a heavy current coil connected in the motor circuit. The function of the two coils in the control circuit is to lift the short circuiting copper discs, and thereby open one of the control circuits, the discs being held up until the motor current in the series coil has fallen to the pre-determined value for which the relay is adjusted. The contacts in the relay are never used for breaking circuit, and are, therefore, not liable to cause trouble by burning. The construction of the control apparatus throughout is of non-inflammable material, and the whole of the insulation is of mica. Practically all the wiring is in the driver's cab, and the connecting train wires and through shoe cable are fixed on the roof of the coach so as to be quite out of reach of unauthorised persons.

The lighting of the compartments has been the subject of careful study and a suitable and tasteful fitting has been adopted.

The coaches are heated by electric radiators suitably grouped in the various compartments. The Westinghouse brake used on the electric trains employs cylinders 12 in. and 14 in. in diameter, and the triple valves are designed to pass on the operation of the driver's brake valve to the rear of the train by a quick serial movement, resulting in the almost simultaneous application of the brakes on a train 600 ft. long, which ensures a smooth and efficient brake service. Air is supplied to the brake system by small compressors direct-driven by slow-speed motors, one of which is placed in each motor car. The action of all these compressors on a train is controlled by a master governor and switch, which produces uniform compressor labour throughout the train, as all compressors start and stop simultaneously. This arrangement is known as the Westinghouse governor synchronising system.

The central power station is at Durnsford Road, Wimbledon, adjacent to the River

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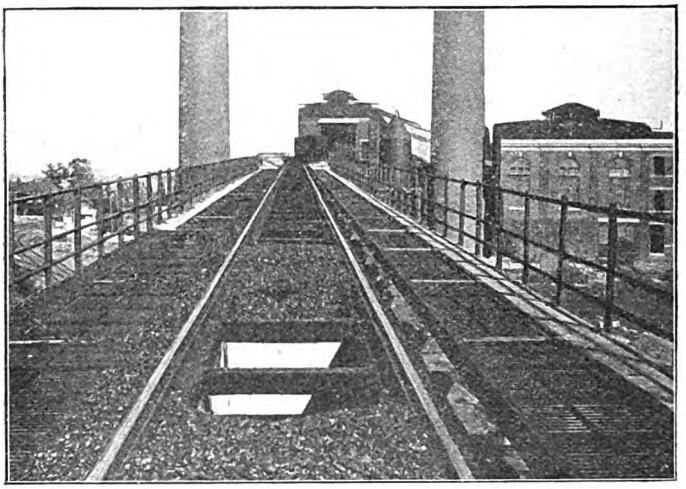


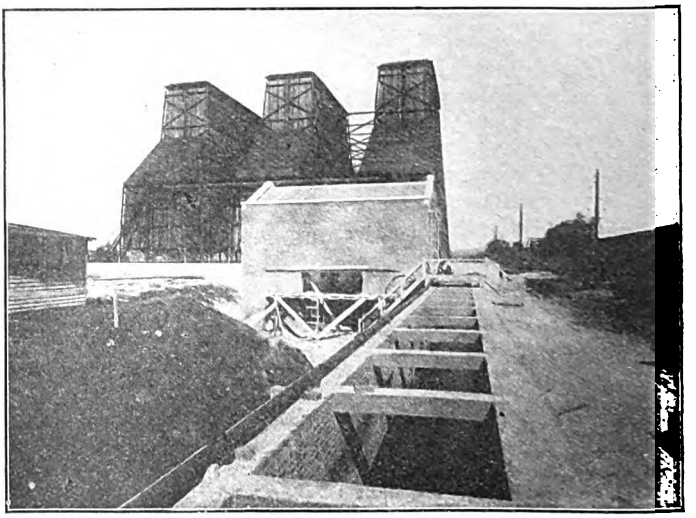
THE COALING GANTRY.

Wandle, from which water is being taken for condensing purposes. The ground slopes gradually towards the power house and the river, and on this account it was found practicable to omit all the usual coal-conveying plant, and to discharge the coal from railway trucks directly into overhead bunkers in the boiler room.

A viaduct constructed for this purpose is, for the greater portion of its length, provided with open decking, so that coal can be discharged from the trucks directly on to a reserve storage space under the viaduct. This space is bounded by a low retaining wall, and has a storage capacity of about 10,000 tons of small coal. Ashes are drawn from the boiler house basement into an overhead receiver outside the building by means of a vacuum system. The viaduct is 550 ft. long by 19 ft. wide, comprising one 50 ft. steel girder span and 20–25 ft. ferro-concrete spans constructed on the Mouchel-Hennebique system.

The power house is a brick building in two sections, the boiler house running parallel to the turbine room. The former is 237 ft. long by 130 ft. wide, and contains 16 Babcock and Wilcox boilers, each having a normal evaporation of over 20,000 lbs. of water per hour. The boilers are arranged in two rows, with a firing floor between them. They are fitted with chain grate stokers, and deliver steam at a pressure of 200 lbs. per sq. in., with a superheat of 200° F. Green economisers are erected behind the boilers. The coal bunkers over the firing floor have a capacity of about 1,400 tons. In the basement is the suction ash plant and the main flues. Two chimneys have been erected outside the boiler house at the permanent end of the building, provision being made at the other end for extension when required. Each chimney is 230 ft. high above ground level, and has an internal diameter of 13 ft. 6 in. at the top.

The turbine room is 257 ft. long by 55 ft. wide, and contains five main and three auxiliary generating sets, with space for a sixth main set when required. The main sets are turbo-alternators of 5,000 kw. capacity running at 1,500 revolutions per minute, and generating at 11,000 volts three-phase. These turbines are of the impulse type, and each of them is provided with a separate surface condenser, situated in the basement. Each set embodies a direct connected exciter



THE COOLING TOWERS AND SCREENING PLANT.

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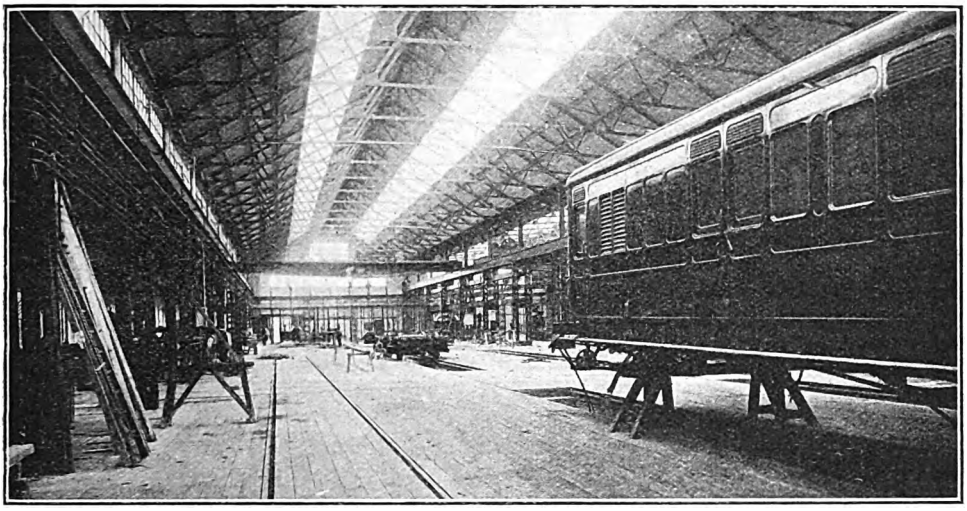
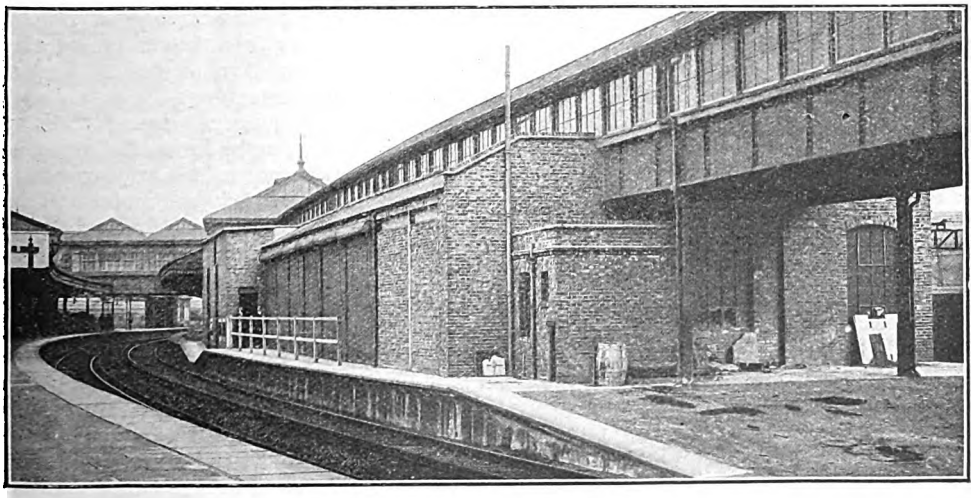


INTERIOR OF REPAIR SHOPS FOR ELECTRIC ROLLING STOCK.

and motor-driven fan for ventilating the alternator. The three auxiliary sets are turbo-generators, each having an output of 400 kw. and supplying continuous currents at 220 volts. Their turbines run at 5,000 revolutions per minute, and drive the generators through gearing at 575 revolutions per minute. These machines supply current for auxiliary power and lighting purposes.

The high and low-tension switchgear is placed in a separate bay, which runs the whole length of the turbine room. This bay is 21 ft. 6 in. wide, and the switchgear is arranged on three floors. The high-tension switchgear is of the remote control type, and is in three groups. The group busbars are connected to the main or interconnecting busbars through oil switches fitted with an automatic maximum release with a time element. Cable boxes and transformers are placed on the turbine room floor, oil switches and operating mechanism on the first floor, on which is also the control room, and the busbars on the second or top floor. The auxiliary switchboard for the 220 volts continuous current supply is erected in the switch-room adjacent to the main control board. A 220-volt battery is also installed for ensuring the supply of current for control purposes. Office and stores accommodation



SUB-STATION BUILDINGS AT CLAPHAM JUNCTION.

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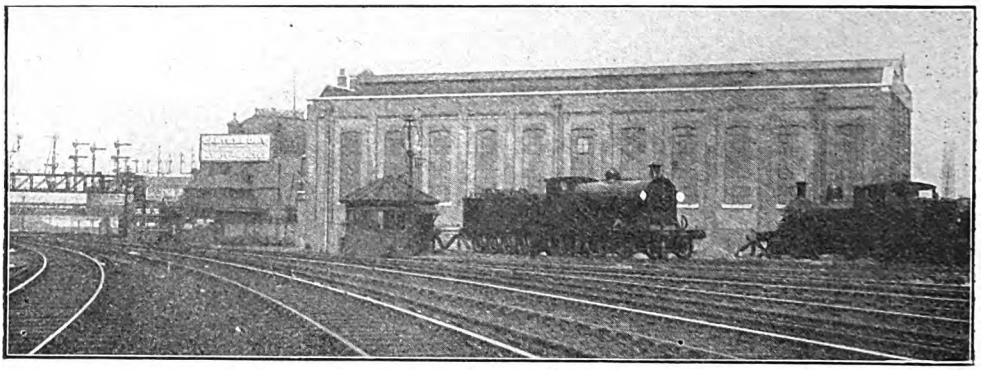
is provided at the permanent end of the switchgear bay.

To ensure a continuous supply of feed water a storage tank, having a capacity of 110,000 gallons runs the whole length of the building on the flat roof over the switchgear bay. With the exception of two of the four boiler-feed pumps and one boiler-sump pump, all the pumps and auxiliary machinery throughout the power house are motor driven. Steam pipes are arranged on the unit system, with a group of four boilers supplying each main turbine; the boilers and turbines can, however, also be opened out to a common main in order to give greater flexibility of working. The turbine room is spanned by a 40-ton travelling crane, operated by three 220-volt continuous current motors.

The power house also contains a motor-driven air compressor and a motor-driven vacuum pump for cleaning purposes, also two exhaust steam-feed water heaters and a water-treating and filtering plant. Under normal conditions the supply of circulating water for the condensers is obtained from the River Wandle, and for the purpose of conveying the water two ferro-concrete ducts have been constructed. Should the supply of water from the river be insufficient, as it may be during a very dry summer, a part or the whole of the circulating water can be drawn from the outlet duct by means of motor-driven centrifugal pumps, and pumped over cooling towers erected beside the water ducts at the end of the power house nearest the river. Two motor-driven screens are provided in the inlet duct for removing leaves, weeds, and other refuse from the river water. The outer or coarse screen consists of fixed bars, cleaned by means of a motor-driven rake, and is capable of dealing with 2,000,000 gallons of water per hour. The inner or fine screen is a rotating disc. The top of the disc is cleaned by water jets, while the bottom portion collects any fine particles or gelatinous matter that have passed through the outer screen. In flowing from the power house back to the river the water forms a series of cascades, and by this means it is cooled to within a few degrees of the inlet temperature before it is finally discharged into the river.

Repair and inspection shops for dealing with the electric trains are provided adjacent to the power house. The high-tension feeders to the sub-stations are three-core, delta section, paper insulated, lead sheathed, single wire armoured, and jute served. Four sizes of cable—namely, ·2 sq. in., ·15 sq. in., ·1 sq. in., and ·06 sq. in.—are used. The cables, as a general rule, are run beside the line upon hooks fixed to posts 5 ft. 6 in. apart. Where it is necessary for them to cross the line, or to run through station platforms, they are laid in asphalte troughing.



WATERLOO SUB-STATION.

A large proportion of the 11,000 volt feeder system is in the form of a ring main, and where duplicate cables are provided in this ring they are fitted with protective gear, consisting of balanced relays, which, in the event of a fault, isolate the length of defective cable at both ends. Duplicate cables which do not form part of the ring main are provided with balanced relays at the feeding end and balanced reversed power relays at the receiving end. Two lengths of single feeder are fitted with Merz-Price protective gear, in connection with which three-core pilot cables have been provided. The 11,000-volt supply is distributed to nine sub-stations, where it is transformed down and converted to

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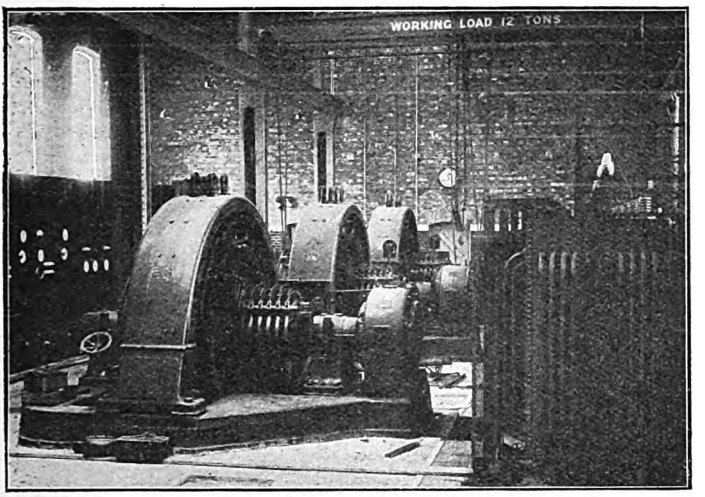
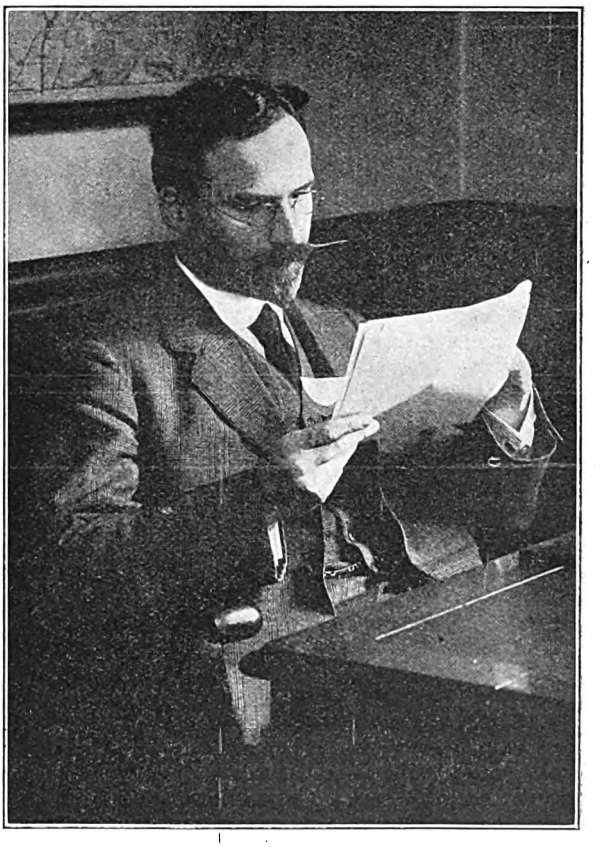


ROTARY CONVERTERS IN WATERLOO SUB-STATION.

continuous current at 600 volts, at which pressure it is delivered to the conductor rails on the track.

The sub-stations are situated at Waterloo, Clapham Junction, Raynes Park, Hampton Court Junction, Kingston, Sunbury, Twickenham, Isleworth, and Barnes. They are generally of similar design, but that at Clapham Junction, placed on No. 5 platform, had to be adapted to the requirements of its location. They contain static transformers, rotary converters, and the necessary high and low-tension switchgear. The rotary converters are of two sizes —viz., 1,875 and 1,250 kw.—and each of them is supplied by three single-phase oil-cooled transformers. The high-tension switchgear is completely enclosed in moulded stone cells, and, with the exception that the oil switches are hand operated, is similar in construction to that installed at the power house. Each of the continuous current feeder panels controls two circuits, each of which has a maximum capacity of 5,000 amperes. The feeder circuit breakers are equipped with indicating lamps which, when the breakers are open, show the position of the breaker through which the different sections of conductor rail are fed from the next sub-station.

The track work involved in the electrification comprises the laying of a third rail and the bonding of the running rails of about 150 single-line miles of railway. The conductor, or third rail, is laid at one side of the track 16 in. from gauge, and 3 in. above rail level. It is of special high conductivity steel, and weighs 100 lbs. per lineal yard. These rails are laid on porcelain insulators, with their contact surface at a height of 3 in. above



Photo] [*Topical.*

MR. HERBERT JONES.

Chief Electrical Engineer: London & South Western Railway.

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MR. A. W. SZLUMPER,
Chief Engineer:
London & South Western Railway.

the track rail and with their centres 16 in. from the gauge side of the track rail. The return circuit is formed by the running rails, the joints of which are bonded with two copper bonds of the protected type placed under the fish-plates. The running rails are cross bonded at frequent intervals to equalise the current returning by the different rails. Current is collected from the conductor rail by cast steel shoes.

The sub-stations, passenger stations, goods yards, and sidings between Waterloo and Clapham Junction, and on the Kingston "Roundabout" line, will take their lighting supply through a separate cable, which will also serve for supplying power in connection with the track circuit signalling arrangements. Single-phase alternating current at a pressure of 3,300 volts is supplied through this cable to static transformers placed in small brick chambers built at intervals along the route, current being transformed down to 220 volts.

The 3,300-volt supply is obtained from frequency changer sets situated at the power house and at Waterloo, Clapham Junction, Raynes Park, and Twickenham. Four of the sets consist of single-phase generators driven by three-phase induction motors, which obtain their supply from the 11,000-volt busbars through step-down transformers. To ensure an absolutely reliable supply, three motor generator sets are also provided. Two of these are at the power house, and consist of single-phase generators direct coupled to 220-volt motors driven off the power house auxiliary supply and storage battery. The third set is at Waterloo sub-station, and the motor driving the generator is, in this case, supplied from a 600-volt battery installed as a standby to the lighting of the terminal station.

MR S. WARNER, Carriage and Wagon Supt.: L. & S.W.R.

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When electrical working is commenced on the loop *viâ* Putney, Richmond, Kingston, and Wimbledon to Waterloo, and this section is in running order, it is expected to lower the schedule time from Waterloo to Teddington by 17 min. At present it takes 50 min. to reach Teddington, so that under the new conditions the time occupied will be only 33 min.

At the time of writing the new schedules to be adopted are not definitely settled, but it is understood that in due course there will be practically a 5 minutes' service throughout the day between Waterloo and Wimbledon, while the trains between London and Kingston will run every 10 min. In some of the trains a portion of the first-class accommodation will take the form of a saloon.

It will be recalled that this important undertaking followed closely upon the appointment of Sir Herbert Walker as General Manager of the Company, and the whole of the electrification scheme has been carried out under his personal supervision, to the designs of Mr. Herbert Jones, the Chief Electrical Engineer. Mr. A. W. Szlumper, Chief Engineer, has been responsible for the constructional work, etc., in connection with the permanent way, whilst the alterations to the rolling stock have been in the hands of Mr. S. Warner, Carriage and Wagon Superintendent. The necessary re-organization of the intricate train working in connection therewith has been arranged by Mr. Henry Holmes, Superintendent of the Line. The Consulting Engineers are Messrs. Kennedy & Donkin, of Westminster

Photo] [*Elliott & Fry.*

MR. HENRY HOLMES, M.V.O.,

Superintendent of the Line: London & South Western Railway.

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Locomotive and Train Working in the latter part of the 19th Century.

GREAT WESTERN RAILWAY. [No. I.]

The Last Years of the Broad Gauge.

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

IT will be convenient to deal first with the broad gauge engines and train services of the Great Western Railway during the last 10 years of their existence, 1882 to 1892. At one period in British railway history Brunel's 7 ft. gauge had extended its tentacles not only from London to Penzance, but also through South Wales to Milford, to Wolverhampton in the Midlands, and to Weymouth on the South Coast. Between 1869 and 1874 it had been converted to standard gauge on all the above sections except the West of England main line between London and Penzance, and several of the branch lines. During the 1880–1884 period, the Clevedon, Yeovil, Barnstaple, Minehead, and Tiverton branches of the Bristol and Exeter section were also converted; so that in 1885 there remained only the following broad gauge lines:—

(1) The main line from Paddington to Exeter, of "mixed gauge" with three rails to each track, through Swindon and Bristol.

(2) The Chard branch, from Creech Junction to Chard—broad gauge only. This was not converted until 1891.

(3) The South Devon and Cornwall railways west of Exeter, which were broad gauge only, with the exception of certain branches and mineral railways in Cornwall, and the mixed gauge of the West Cornwall Railway.

Of the 236 miles 24 chains from London to Penzance, about 100 miles were exclusively broad gauge, all of which lay west of Exeter. Of the Plymouth and Launceston branch—34¼ miles—nearly 12½ miles were exclusively broad gauge, and the remainder was of "mixed gauge," as the London and South Western Railway used a portion of this line.

Dealing firstly with the section between London and Bristol, there were until the summer of 1887 six express and fast passenger trains in each direction, of which four were to and from Penzance, and the other two to and from Plymouth. The other expresses, and all the slow trains, were "narrow" (standard) gauge. These six broad gauge trains departed from and arrived at Paddington as follows:—

DOWN.

Departure.

5.30 a.m.	Newspaper Express, London to Penzance.
9.0 a.m.	Morning Fast, London to Penzance.
11.45 a.m.	"Flying Dutchman," London to Penzance.
3.0 p.m.	"Zulu," London to Plymouth.
5.0 p.m.	Evening Fast, London to Plymouth.
9.0 p.m.	Mail, London to Penzance.

UP.

Arrival.

4.0 a.m.	Night Mail, 5 p.m. from Penzance.
2.45 p.m.	Up "Dutchman," 8.35 a.m. from Plymouth.
5.0 p.m.	6.45 a.m. from Plymouth.
6.0 p.m.	Day Express, 6.25 a.m. from Penzance.
8.10 p.m.	Up "Zulu," 11.15 a.m. from Penzance.
10.20 p.m.	Fast, 10 a.m. from Penzance.

On Sundays the down and up night mails were the only broad gauge trains. There was no "up" broad gauge train from Bristol to London between the midnight mail due in London at 4 a.m. and the up "Dutchman," which left Bristol at 12.9 p.m. and arrived at Paddington at 2.45 p.m. Of the above trains the "Dutchman" and the "Zulu" in both directions conveyed first and second class passengers only.

The up train due to leave Bristol at 3 p.m. and arrive at Paddington at 6 p.m. was much the heaviest and most popular train of the day, for it conveyed third class passengers,

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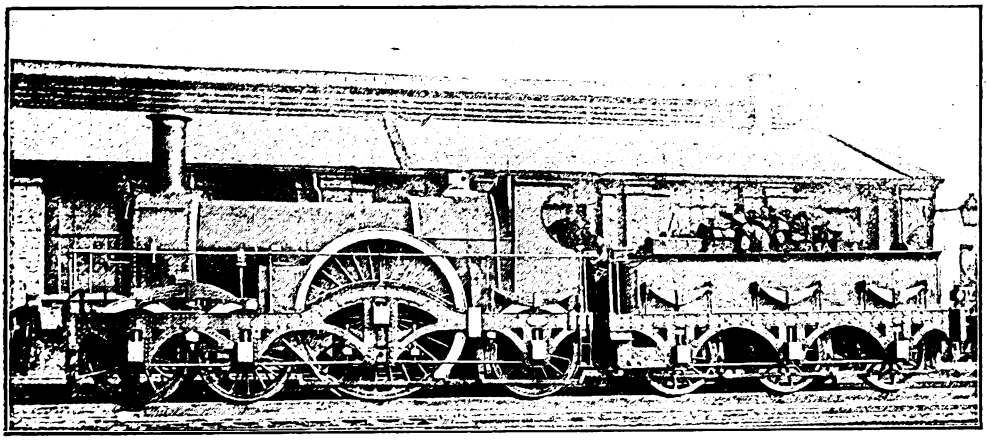
whereas the up "Dutchman," which preceded it, and the up "Zulu," which followed, had no third class accommodation. The 10 a.m. slow from Penzance—7 p.m. from Bristol to London—was known as the "North Mail." From Newton Abbott it was a fast train and had a mail van for Bristol, which conveyed the mails from the West of England to connect with the 7 p.m. Midland through mail train from Bristol to Newcastle. This latter train in its turn made a connection at Tamworth with the London and North Western Railway main line mail trains.

There was, in addition to the above broad gauge trains, a heavy excursion train which left Paddington on Friday mornings only on a saunter to the West. This train usually included a ramshackle collection of coaches, ranging from high-class eight-wheelers down to weird-looking six-wheeled South Devon and Cornwall stock, which had to be seen to be properly appreciated. There was a corresponding up train each week.

In 1887 new broad gauge expresses were added to the list, one in each direction, namely, the "Jubilees." The down train left Paddington at 1 p.m. for Plymouth, and the up train departed from the latter station at 12 noon, and reached Paddington at 6.30 p.m. The "Jubilee" expresses conveyed third class passengers, much to the regret of some of the old-fashioned officials at Paddington, but as it had to be done, they took their revenge by timing the trains in 95 min. for the Paddington–Swindon non-stop runs instead of the 87 min. allowance for the older and more select expresses.

To the above-mentioned passenger service should be added the two fast goods trains in each direction between London and Bristol. These conveyed only through loads for stations west of Exeter. The first one left London in the morning, and the other, known as the "Broad Gauge Tip," departed at 10.25 p.m., though at one time 10.15 p.m. was its time table time. The origin of this nickname, by which it was always known and referred to, is wrapped in obscurity. Every railwayman on the main line or in the West knew of the "Tip," but I never found one who could tell me why it was so called.

All the passenger trains between London and Bristol, with the exception of one in each direction, were worked by London engines. The exceptions were the up "Dutchman," which arrived at Paddington at 2.45 p.m., and the 5 p.m. down train, which were allotted to a Bristol engine.



BROAD GAUGE 8 FT. SINGLE ENGINE *Tartar.*
Taken at Westbourne Park engine sheds.

The engines stationed in London were all of the celebrated 8 ft. single type. Originally designed in 1847, and constructed at Swindon between then and 1851, there had been 24 engines of the class, to which seven were subsequently added in 1854–5, constructed by Messrs. Rothwell & Co., of Bolton. Nearly all of them had been completely renewed by the end of 1880, so that only a portion of some of the original engines remained, and the dimensions as to wheelbase and boilers had been slightly altered. From the end of 1880 there were 23 of them at work, of which two of the London engines —*Estafette* and *Prometheus*—were scrapped in 1885 and 1887 respectively. The *Estafette* —to call it by its intended and proper name

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—was remarkable for having its name spelt *Estaffete*, and the error was never corrected. The other London engines were *Alma, Bulkeley, Courier, Crimea, Eupatoria, Great Britain, Hirondelle, Iron Duke, Rover, Sultan,* and *Tartar*. The two last-named engines were distinguished by the possession of whistles, which emitted a piercing shriek of the "wild cat" order.

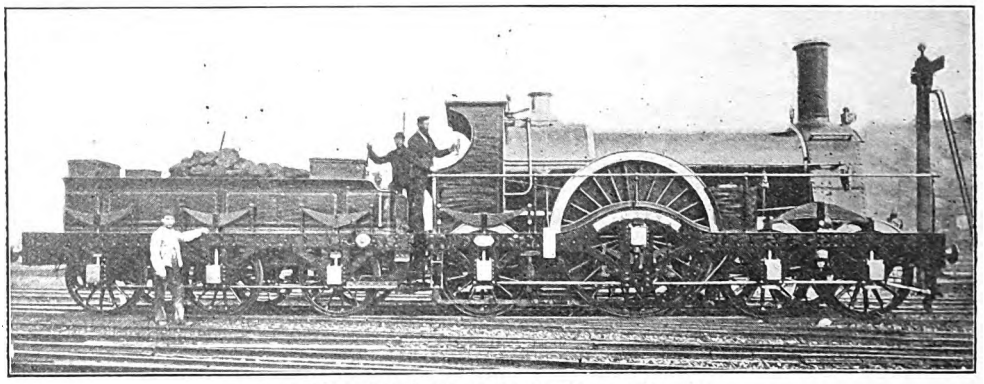
In 1888, after the new "Jubilee" expresses had been introduced, three more of the class were built at Swindon, and took the names of previous engines of the type, which had been broken up. Two of these—the *Great Western* and the *Prometheus*—were stabled at the London shed.

Dimensions of these celebrated engines were: Cylinders, 18 in. diameter by 24 in. stroke; single driving wheels, 8 ft. diameter; two pairs of leading wheels, and the trailing wheels, 4 ft. 6 in. diameter; boiler pressure, 140 lbs. per sq. in. The heating surface varied somewhat, being 1,728 sq. ft. in the 1878 renewals, 1,751 sq. ft. in the 1880 renewals, and 2,064 sq. ft. in the three 1888 engines. These last had boilers 4 ft. 10 in. maximum diameter, whereas most of the others had 4 ft. 6 in. barrels, though some were 4 ft. 9 in. diameter.

Of the trains between London and Bristol the 5.15 a.m., 9 a.m., 5 p.m., and 9.15 p.m. down, together with most of the corresponding up trains may be dismissed in a few words. They ambled along in a lordly and somewhat leisurely way with stops at Reading, Didcot, Swindon, Chippenham and Bath. At Swindon they put in a 10 min. stop "for refreshments." Years before, the Great Western Railway had sold their Swindon birthright, in so far as refreshment rooms were concerned, for a mess of pottage, and a clause in the agreement made it compulsory for all trains to stop 10 min. for the benefit of bun-struggling passengers, the only exceptions being the night mails, which came off with 5 min. halts.

Of the up trains corresponding to the above down trains, one showed a laudable desire to get along. This was the 3 p.m. from Bristol, which left Swindon at 4.5 p.m. and ran from Didcot to Westbourne Park without stopping. Consequently, a good many citizens of Reading, who were unaccustomed to this sort of thing, were overcarried, until the company stationed a ticket collector at Didcot, who was possessed of a stentorian voice, and announced to all and sundry that the next stop was Westbourne Park in a tone that threatened dire penalties for those who did not pay due attention.

The real expresses were the "Dutchman" and "Zulu," and after 1887 the "Jubilee."*



BROAD GAUGE 8 FT. SINGLE ENGINE *Courier*.

For many years the booked speed of the two former trains between London and Swindon was the fastest in the country, unless we except the short-lived Great Northern Leeds expresses of 1880. After 1885 the Great Northern Manchester expresses came very near to them in the King's Cross–Grantham runs.

The timing of the 3 p.m. "Zulu" was:—

Miles.				*Speed.*
—	Paddington	dep.	3.0 p.m.	53¼ m.p.h.
77¼	Swindon	arr.	4.27 p.m.	
—	"	dep.	4.37 p.m.	47 m.p.h.
106¾	Bath	arr.	5.15 p.m.	
—	"	dep.	5.20 p.m.	44 m.p.h.
118½	Bristol	arr.	5.36 p.m.	

The down "Dutchman" was almost identical as regards speed. The up "Dutchman," Swindon depart 1.18 p.m., Paddington

* The "Cornishman" was added in 1890.

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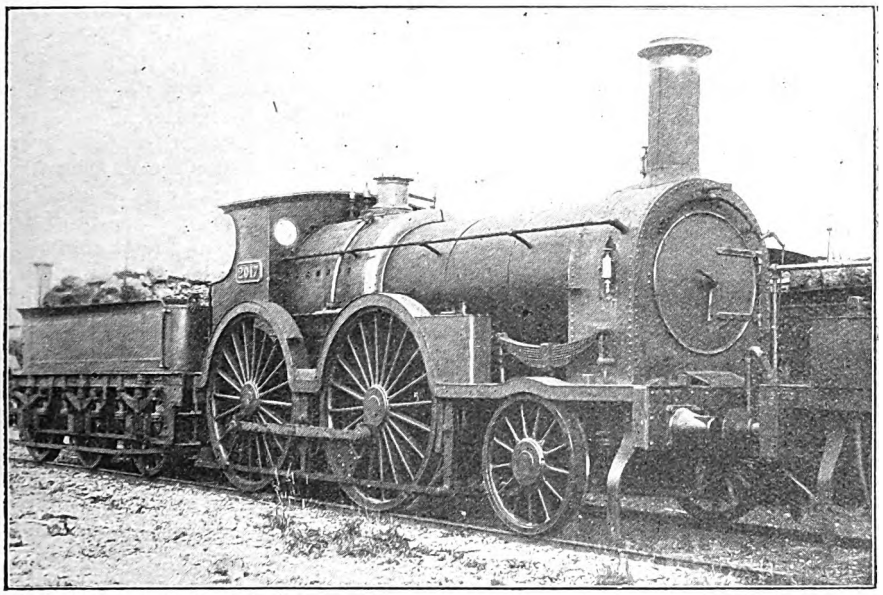
arrive 2.45 p.m., was also booked in 87 min., but the up "Zulu," which left Swindon at 6.42 p.m., was allowed 88 min. for the run.

Now I much regret to have to state that the Paddington–Swindon run of the down "Dutchman" was not often performed in the allotted 87 min., and that 2 or even 3 min. were very frequently dropped. The "Zulu" was slightly better, but this train had often 1 min. against it by the time it reached Swindon. The load of the 11.45 a.m. was usually five 8-wheeled coaches, though very frequently there were six and occasionally seven. The 3 p.m. on the other hand rarely had more than five. The coaches would weigh about 24 or 25 tons each. I came to the conclusion, as a result of many observations, that on the London-Swindon run, which is really a steady if very gradual rise, the engines could keep time with six broad gauge eight-wheelers only in the best of weather with no head wind, and when the engines were "thumped." Now the drivers had a good reason for not "extending" their engines as far as Swindon. The Swindon stop existed chiefly on account of buns, sandwiches and liquid refreshments, and as none were offered to the driver, he naturally took very little interest in them. Moreover, the Swindon to Bath run was a downhill performance, which included the Wootton Bassett and Box Tunnel banks of 1 in 100, and as these runs were booked at only 47 miles per hour, there was not the least difficulty in picking up the 2 and 3 min. dropped between London and Swindon, and reaching Bath to time, and generally I may say this was done. I think it is fair to say that the 53¼ miles per hour speed of the down broad guage expresses existed mainly on paper and not in reality. On the other hand the up trains between Swindon and Paddington, with the gradient in their favour, generally kept excellent time, and frequently did the distance in 85 min. As a matter of opinion, I do not think there would have been the least difficulty in doing the up run in 77 to 80 min., had it been necessary.



NO. 2017. 6 FT. 6 IN. COUPLED BRISTOL AND EXETER ENGINE.

A few examples of actual performances may be of interest. The first was the 11.45 a.m. "Dutchman," engine *Rover*, load seven 8-wheeled coaches. Maidenhead was passed in 30 min. 39 sec. from the dead start, the maximum speed at the 24th post being 58·1 miles per hour. The section thence to Reading took 13 min. 8 sec., the maximum being 56·3 miles per hour at the 35th post. Didcot was passed in 18 min. 55 sec. from Reading, the maximum being 56·3 miles per hour at several points, and a similar maximum was attained between Didcot and Swindon at the 73rd post. Swindon was reached in 90 min. 52 sec. from Paddington, instead of in the 87 min. booked time, and at no point was a speed of 60 miles per hour reached.

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The second run was with engine *Eupatoria* on the same train and with the same load. From Paddington to the 37th post, the time taken was 44 min. 13 sec., as against 44 min. 56 sec. by *Rover*, to the 54th post from London 62 min. 42 sec. as compared with 63 min. 57 sec. Between Didcot and Swindon there was a slight signal slack, so that *Eupatoria* reached Swindon in 90 min. 50 sec. The maximum speed was 61 miles per hour, the 3 miles between the 45th and 48th post being covered in 2 min. 59 sec.

On the 3 p.m. "Zulu" from Paddington, with six 8-wheeled coaches and engine *Hirondelle*, the 37th post was passed in 42 min. 20 sec., a considerably better performance than either of the two preceding ones, though with a lighter load. Signal slacks interfered with the remainder of the run, but the whole of the final distance from the 60th to the 76th post was covered steadily at 55½ miles per hour with hardly any variation of speed. At only one point, the 22nd mile-post, did the speed just reach 60 miles per hour.

Between Swindon and Bath it is unnecessary to give detailed particulars. The maximum I ever registered on this section was 66½ miles per hour down the Wootton Bassett bank, with engine *Alma*, for a distance of 4¼ miles.

On the up journey between Swindon and Paddington much the best performances registered by me were on the 6.42 p.m. up "Zulu" from Swindon. The "Zulu," I may remark, made a connection with the north by slipping a coach at Didcot. I regret, however, that I am unable to find my records of this train. On the other hand I must admit that time was sometimes lost even with the up trains. I have a record of one extremely sorrowful performance on the part of the *Iron Duke* with the up "Dutchman," with which it left Swindon 24½ min. behind time, and notwithstanding this incentive to running, arrived at Paddington 28½ min. late, having dropped 4 min. with a load of seven 8-wheeled, and one 6-wheeled, coaches (one slipped at Reading). But the *Iron Duke* always appeared to me to put up the most "streaky" performances, occasionally running fairly well, and at other times exhibiting the erratic inconsistencies of a commissariat camel. Moreover, the *Iron Duke* was then, I believe, a London engine worked (on the up "Dutchman") by a Bristol driver, who would probably be unacquainted with the *Duke's* little ways. It was afterwards transferred to Bristol for some time.

Although the speed of the majority of the Great Western expresses in "the 'eighties" left a great deal to be desired, it must be said that many of their goods trains ran really well. The broad gauge "Tip" ran from London to Reading at 34 miles per hour, thence to Swindon at 33 miles per hour, and from Swindon to Bristol at 35·3 miles per hour. It took some of the passenger trains all their time to keep out of the way of this goods train, which was worked by the Bristol 2–4–0 engines Nos. 2015 to 2024, originally Bristol and Exeter engines. There were no broad gauge goods engines at the London end, except, I believe, one six-coupled "Convertible," retained as a spare engine in case anything happened to the Bristol engines. The 2015 class were really passenger engines with 6 ft. 6 in. coupled wheels, and 17 in. by 24 in. cylinders. They were not "good riding" engines, as their connecting rods were very short, and I rarely saw them on passenger trains. They were stationed at Bristol for the fast goods services both to London and to Newton Abbot. Their passenger work was confined to an occasional piloting job, though, of course, they had taken a share in their earlier Bristol and Exeter days. They had been built by the Bristol and Exeter Railway between 1870 and 1872 at Bristol.

(*To be continued.*)

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Light Railways. [No. II.]

By HARRISON VEEVERS.

Parliamentary Assistant to Chief Engineer, Lancashire & Yorkshire Railway.

(*Continued from Page* 286, *October Number*).

SECTION 3 of the Light Railways Act, 1912, defines the Light Railway Commissioners as the Government Department for the purposes of applications for advances under the above Act of 1909.

(9) A certificate that a fee of £50 has been paid to the Board of Trade.

In addition to the above the following documents must accompany the application to the Commissioners or be deposited with them on or before the last day of the month after the month in which the application is made.

A statement so far as can be made whether the owners, lessees or occupiers on whom notices have been served in each case assent, dissent, or are neuter or have returned no answer in respect of the application.

In the case of an existing company a certificate must be deposited with the Commissioners before the local inquiry is held showing that members of the company have assented to the application by such a resolution as is required by the Standing Orders of Parliament in the case of an application to Parliament.

This resolution has to be carried at a meeting held specially for the purpose and known as a "Wharncliffe Meeting."

When the application has been lodged with the Commissioners they have to satisfy themselves that all reasonable steps have been taken for consulting the local authorities (including road authorities) through whose areas the line is intended to pass and the owners and occupiers of the land it is proposed to take and as to whether public notice has been given of the application.

Applicants for an order are to satisfy the Commissioners that they have published the necessary advertisements and served the required notices. The Commissioners then hold a public local enquiry and by this and any other means they may think necessary obtain all the information that they consider useful to them for arriving at a decision. Before a decision is come to the Commissioners must give an opportunity for all objections to be laid before them and they must consider them whether made formally or informally.

Objections must be made in writing to the Commissioners and any of the following classes of persons will be entitled to be heard in opposition to a scheme, if objection has been lodged by them.

(*a*) Any owner, lessee or occupier of land proposed to be acquired, or which it is alleged will be injuriously affected by the proposal.

(*b*) The local authorities, including road and street authorities through whose areas, roads or streets the light railway is intended to pass or to be laid.

(*c*) Any railway, tramway, canal or other company or person upon any part of whose works accommodation is proposed to be taken or in any other manner interfered with by or for the purpose of the light railway.

(*d*) Persons, associations, etc., objecting to the application on the ground that the proposed undertaking, if carried out will injure or destroy any building, or other object of historical interest or will injuriously affect any natural scenery.

(*e*) All other parties interested (*i.e.*, those who have a real concern in the case).

The local inquiries are conducted on broad lines and are free from technicalities and work very well. The Engineer member of the Commission serves a most valuable purpose in dealing with practical questions which arise.

When the Commissioners have heard the promoters in favour of the application, and all the parties entitled to be heard in opposition, and have satisfied themselves on all the matters previously mentioned they must consider whether the application should be granted. If the Commissioners are of opinion that the Order should be allowed they must arrange the details which they consider necessary for the proper construction and working of the railway.

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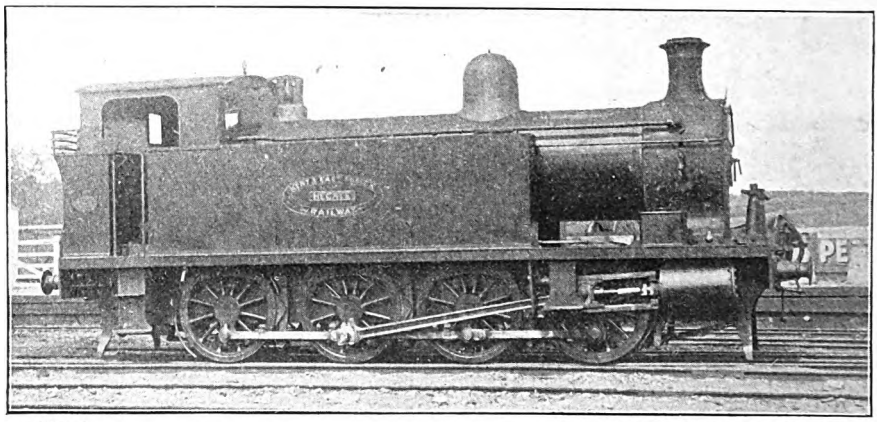

Photo] [*Loco. Publishing Co., Ltd.*

0-8-0 TANK ENGINE: KENT AND EAST SUSSEX RAILWAY.

Where an application for a light railway, made by any county borough or district council has been refused by the Commissioners, an appeal against such refusal may be made by the council to the Board of Trade. No authority is given in the Act of 1896 for an appeal against the refusal of the Commissioners to grant an application for an Order made by any company or person promoting a light railway.

When the Commissioners have finally settled an Order, it must be submitted by them to the Board of Trade for confirmation, accompanied by such particulars and plans as the Board may require, together with a report stating the objections which have been made to the application and the manner in which they have been dealt with and any other matters in reference to the Order which the Commissioners may think fit to insert in the report.

When the Order is submitted to the Board of Trade for confirmation they must give public notice and state that any objections to the confirmation of the Order must be lodged with them and the date by which the objections must be in.

The notice is published in the form of an advertisement once in each of two successive weeks in the local newspaper in which the original notice of the application to the Commissioners appeared, and the time within which objections are required to be lodged is three weeks from the first publication of the notice.

After the receipt of the Order from the Commissioners the Board of Trade consider it with special reference to :—

(1) The expediency of requiring the proposals to be submitted to Parliament.

(2) The safety of the public.

(3) Any objections lodged with them in accordance with the Act.

The Board can modify the provisions of the Order for ensuring the safety of the public in any way they consider necessary, and they must consider all objections lodged with them, and not withdrawn, and give to those by whom they are made an opportunity of being heard. They may then modify an Order so as to remove any objection, or reject the Order altogether, or remit it to the Commissioners for further consideration, or themselves hold a local inquiry and hear all parties interested.

They can reject a scheme and insist on its reference to Parliament on any of the following grounds :—

(1) By reason of its magnitude.

(2) Its effect upon any existing railway company.

(3) Or for any other special reason relating to the undertaking.

Under the Light Railways Act, 1896, if the Board, on consideration, were of opinion that on any of the above grounds the proposals ought to be submitted to Parliament, they were not to confirm the Order. This meant that the application to the Light Railway Commissioners having failed, the promoters, if they still desired their scheme, would have to apply to Parliament by Private Bill in the usual way. Under the Light Railways Act, 1912, this was amended so that the Board may, if they think fit, submit the proposals to Parliament by

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bringing in a Bill for the confirmation of the Order, which would follow the usual procedure of the Board of Trade's Confirmation Bills.

This method of dealing with Orders which the Board are not empowered to confirm will be more economical for promoters of schemes, as presumably the plans deposited with the Commissioners and the notices to owners, etc., will be used for the purposes of the Confirmation Bill, and the expense of depositing a Private Bill will be avoided. It will not be any more costly to opponents, as the opposition to a Confirmation Bill is a very similar proceeding to that of a Private Bill.

Applications have been rejected by the Commissioners under the Act of 1896 owing to their effect on existing railways; also on the grounds that the interests of landowners and of corporations had not been sufficiently considered. Instances are also on record where applications have been refused as the Commissioners did not consider that a sufficient case had been made out as to the need of the line in the public interest, and in other cases that the promoters had failed to deposit, in compliance with the Board of Trade rules, the copies of the draft Order and other necessary documents with the Government departments.

They are often rejected when there is not sufficient evidence of financial support.

Light railways in practice and in reports of the Commissioners to the Board of Trade are divided into three classes:—

(1) Light railways on public roads or streets and which may be shortly described as tram railways.
(2) Light railways resembling ordinary railways constructed on land acquired for the purpose.
(3) Light railways partly on roads or streets and partly on land acquired for the purpose.

The fact that the principal Acts of Parliament relating to railways do not apply to those constructed under the Light Railways Acts except so far as they are incorporated by the special Order authorising the light railway, removes many restrictions enforced on an ordinary railway. It appears, however, that both the Commissioners and the Board of Trade have power to insert many of these restrictions; and this actually occurred in an application by one of the principal railway companies in England, who informed the Board of Trade that they could not undertake to construct the light railway owing to the proposed imposition of practically the same conditions which apply to ordinary railways.

In the case of tram railways, it appears to be the custom to insert in the Order a clause that "The railway may be used for the purpose of conveying passengers, goods, minerals, parcels and animals." This is, no doubt, an extra precaution, because in the Tramways Act, 1870 (Section 10), the nature of the traffic has to be stated in a Provisional Order.

In the case of light railways through land acquired for the purpose, as there is nothing in the Light Railways Acts prohibiting the carrying of goods, minerals and animals, this clause is not inserted in the Orders.

There is a great difference between light

SELSEY STATION: WEST SUSSEX LIGHT RAILWAY.

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MALVERLEY BRIDGE: SHROPSHIRE AND MONTGOMERYSHIRE LIGHT RAILWAY.

railways and ordinary railways authorised by Parliament in the signalling arrangements, platforms, brake power and arrangements at level crossings of roads.

A schedule relating to these matters is usually annexed to the Order as follows:—

Signals.—No signals other than those at any junction of the railway with a passenger line of an ordinary railway or of another light railway need be interlocked with the points. At places where under the system of working for the time being in force trains may cross or pass one another there shall be a home signal for each direction at or near the extreme points. If the home signal cannot be seen from a distance of a quarter of a mile, a distant signal must be erected at that distance at least from the entrance points.

The home signals and distant signals may be worked from the station by wires or otherwise.

At each junction of any portions of the railways there shall be separate home signal arms for each line. If any such signal arm cannot be seen from a distance of a quarter of a mile, a distant signal must be erected at that distance at least from the junction. The home signal arms and the distant signals (if any) shall be so arranged that the signal or signals for one line cannot be lowered when the signal or signals for the other line are down.

Every signal arm shall be so weighted as to fly to and remain at danger on the breaking at any point of the connection between the arm and the lever working it. Precautions are to be taken to the satisfaction of the Board of Trade to ensure that no signal can be lowered unless the points are in the proper position and that two conflicting signals cannot be lowered simultaneously.

Whilst these rules are, no doubt, sufficient to ensure the safety of the public it will be admitted that there is a considerable difference between those required for an ordinary and a light railway.

Platforms.—These are to be provided to the satisfaction of the Board of Trade, unless all carriages in use on the railway for the conveyance of passengers are constructed with proper and convenient means of access to and from the same from and to the level of the ground on the outside of the rail.

There shall be no obligation on the Light Railway Company to provide shelters or conveniences at any station or stopping places; in other words, station buildings are unnecessary.

Brake Power.—No train carrying passengers need be provided with continuous brakes, but every such train shall be provided with brake power sufficient and at all times available for the immediate stoppage of any portion of the train which might under any circumstances break away from the rest.

The brakes are to be either manned or automatic, and the braked vehicles are to be placed in the rear of the vehicles, to be

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controlled so as at all times to maintain complete control over the train.

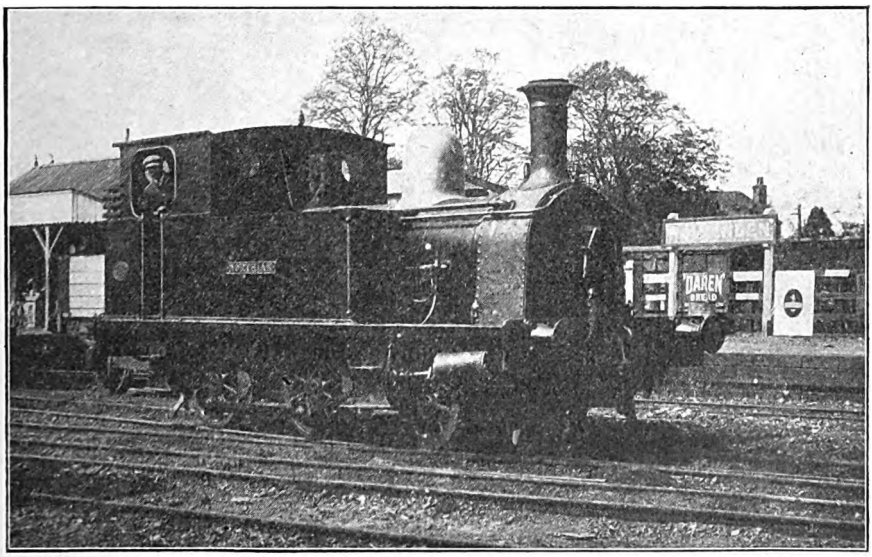
The promoters are not compelled to fence the line of railway, but if within two years after the opening of the railway for public traffic, the owner of any land adjoining the railway gives notice in writing requiring the erection of a fence between the line of railway and the land of such owner, this must be done. If the fence is not continuous throughout the whole of the line of railway, cattle guards or other suitable contrivances are to be erected at the ends of the fencing so as to prevent cattle or horses from entering upon the railway.

There is no provision in the Light Railways Acts to compel the promoters to erect bridges at level crossings and there is usually a special clause in the Order that the promoters may carry the railway on the level over any public or private road shewn on the plan. It is not necessary (unless the Board of Trade orders it) to erect gates across the railway at these level crossings, but in cases where there are no gates and the railway or the road is fenced, cattle guards or other suitable contrivances are to be erected at each side of the road so as to prevent cattle or horses from straying upon the railway and in addition to this, at each of two points 200 yards along the railway in both directions from the level crossing a white post 5 ft. above the ground must be erected having plainly upon it a figure indicating the number of miles an hour which is fixed under the Order as the maximum speed of a train or engine approaching and within 200 yards from a level crossing, usually ten miles an hour.

At each of two points 50 yards along the road in both directions from the point of crossing a notice board shall be erected and maintained cautioning the public to beware of the trains.

Speed is limited to 25 miles an hour and not more than 10 miles an hour over any curve of less than 9 chains radius, or across a level crossing where there are no gates. There is a provision in the Light Railways Act, 1896 (Section 23) that any junction of a light railway with any existing railway shall, so far as is in the opinion of the Board of Trade reasonably practicable avoid interference with lines of rails used for passenger traffic, and as the object of light railways is chiefly for the conveyance of goods and minerals a proposed junction with an ordinary railway is usually shewn to be with a siding.

There is at least one instance of a light railway being deposited with a proposed junction with an important passenger line of one of the large railway companies in England, but the application was opposed by that company and the Commissioners, on account of that opposition stated that



KENT AND EAST SUSSEX RAILWAY.
0-6-0 tank engine *Northiam* at Rolvenden station.

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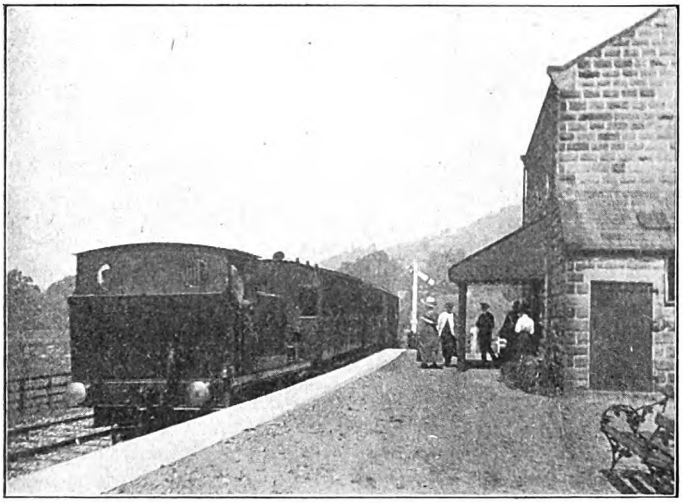


Photo] [*A. Robinson.*

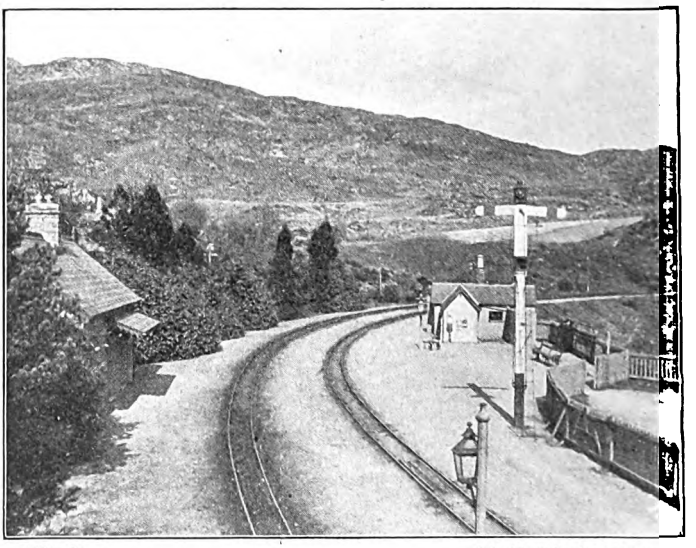
NIDD VALLEY LIGHT RAILWAY.
Train entering Wath-in-Nidderdale station.

they could only authorise the light railway to a siding adjoining the existing railway.

Section 25 of the Light Railways Act, 1896, makes the powers of the Postmaster General with regard to telegraphs in respect of a Parliamentary railway equally applicable to a light railway. Section 18 of the Light Railways Act, 1896, gives an existing company who have acquired the authority of Parliament to construct or work an ordinary railway, permission to apply for an Order authorising them to abandon the construction or working of the railway or any part of it as an ordinary railway, and the Commissioners may authorise by an order the abandoning of any of the works authorised by the private Act of the Company and the Order, when confirmed by the Board of Trade, will repeal any of the provisions of the private Act which may be inconsistent with the construction or working of the railway as a light railway.

This is not entirely a new power as by Section 27 of the Regulation of Railways Act, 1868, the Board of Trade were authorised to grant a similar licence. One would imagine that this is a power that would appeal to many existing railway companies as regards branch lines where there is little traffic and thus do away with the maintenance of many of the expensive signalling and other arrangements required in the case of a line authorised by Parliament. There are instances where applications of this kind have been granted.

An interesting provision in the Act of 1896 is that in Section 22 if any objection to an application for authorising a light railway is made to the Commissioners or the Board of Trade on the ground that the proposed undertaking will destroy or injure any building or other object of historical interest, or will injuriously affect any natural scenery, the Commissioners and the Board of Trade are to consider any such objection and give to those by whom it is made a proper opportunity of being heard in support of it. It is not unlikely that the Windermere and District Light Railway deposited



Photo] [*A. V. Higginbotham.*

TAN-Y-BWLCH STATION: FESTINIOG RAILWAY.

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Photo] [*T. E. Greig.*

11 A.M. TRAIN LEAVING DORNOCH FOR THE MOUND JUNCTION TO CONNECT WITH HIGHLAND RAILWAY TRAINS.

The Dornoch Light Railway is worked by the Highland Railway.

in November, 1899, was withdrawn by the promoters, as much opposition under this Section was raised against the scheme.

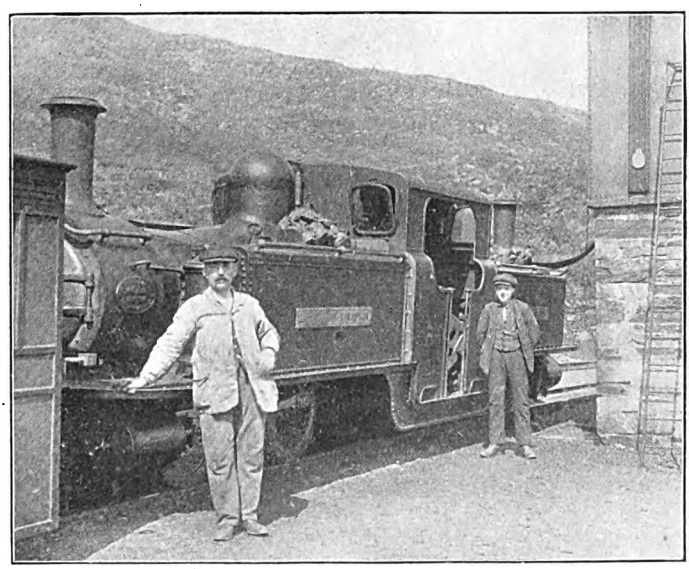
It may be of interest to give some reasons why a great many tramways along public roads are deposited as light railways and the powers not obtained, as they should be, by private Act of Parliament or a Provisional Order of the Board of Trade confirmed by Parliament. Possibly one of many reasons is on the ground of expense, as the cost of a light railway application must be less than in either of the other alternatives.

Again, many of the restrictions put upon a tramway authorised by statute are not included in a light railway Order. On the plan deposited for a tramway no "limits of deviation" are necessary, but it must be shewn whether the line is to be single or double and all passing places indicated, and although under an Act of Parliament or Provisional Order power is given to the Board of Trade to sanction a double line where a single line has been authorised, there is a proviso that a less space than 9 ft. 6 in. between the nearest rail of the tramway and the outside of the footpath on either side of the road must not be given if one third of the owners or one third of the occupiers of the houses, shops or warehouses abutting upon the part of the road where such less space is proposed, by notice in writing addressed to the promoters express their objection to it.

On the deposited plan for a light railway either through private land or along public roads "limits of deviation" must be shewn and the railway may be constructed within those limits, and as a centre line only is necessary (as in the case of an ordinary railway) the promoters may construct either a single or double line without the restriction enforced under the Tramways Act, 1870, of getting the consent of owners and occupiers to construct the nearest rail within 9 ft. 6 in. of the outside of the footpath. This is no doubt an important factor in assisting promoters to decide in which manner they will obtain their powers.

Then on the question of rating, light railways being essentially "railways" within the meaning of the Public Health Act, 1875, are only assessed to General District Rates at one fourth of their net annual value, whereas Tramways authorised under the Tramways Act would be assessed at their full value.

The time allowed for the completion of



Photo] [*W. J. Norton.*

FESTINIOG RAILWAY.

Fairlie Double locomotive *Livingston Thompson*, at Tan-y-Bwlch.

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the works authorised by a Light Railway Order is five years, but under a Provisional Order which incorporates the Tramways Act only two years is allowed. This is, however, often varied when the powers are obtained by a private Act of Parliament.

It was probably never intended that the Light Railways Acts should be used as a means of authorising what are ordinary tramways along public roads, and although the late Sir John W. Maclure asked a question in Parliament on the subject the reply gave no satisfaction, as whatever the intention may have been there is nothing in the Light Railways Acts to prevent them from being used for that purpose.

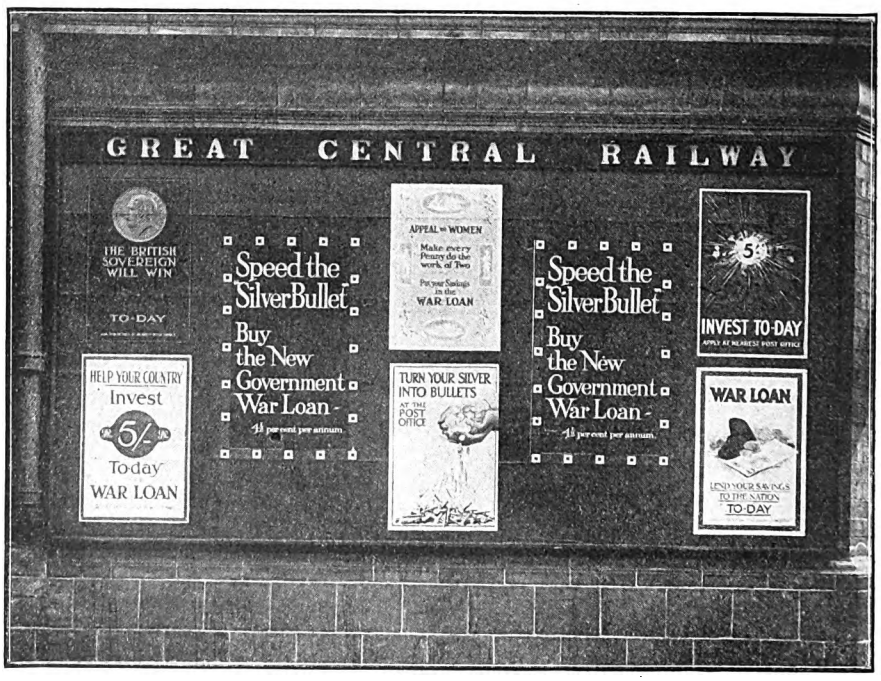
There can be no doubt of the popularity of the Light Railways Acts as an extract from the annual report of the Commissioners issued in April, 1914, will shew :—

The total length of railways deposited was 4,928 miles, and the engineers' estimates totalled £38,851,486.

Of these figures the railways on lands acquired were 2,739 miles in length and the engineers' estimates £18,108,850 whereas the railways on public roads were 1,996 miles in length and the engineers' estimates £19,089,824, the remaining mileage and estimates being made up of the railways partly on land acquired for the purpose and partly on roads, and amending Orders.

If the totals approved only are taken, viz. :—440 Orders, length 2,251 miles and engineers' estimates £16,984,712 of which 1,542 miles and engineers' estimates of £9,925,622 are for railways on lands acquired and 653 miles and engineers' estimates £6,288,389 for lines on public roads, these figures shew conclusively that the Light Railways Acts have to a great extent justified their existence.

A GREAT CENTRAL RAILWAY CONTRIBUTION TO WAR LOAN PUBLICITY.



THIS INTERESTING EXHIBIT OF WAR LOAN POSTERS IS PLACED OUTSIDE MARYLEBONE STATION, WHERE IT ATTRACTS CONSIDERABLE ATTENTION.

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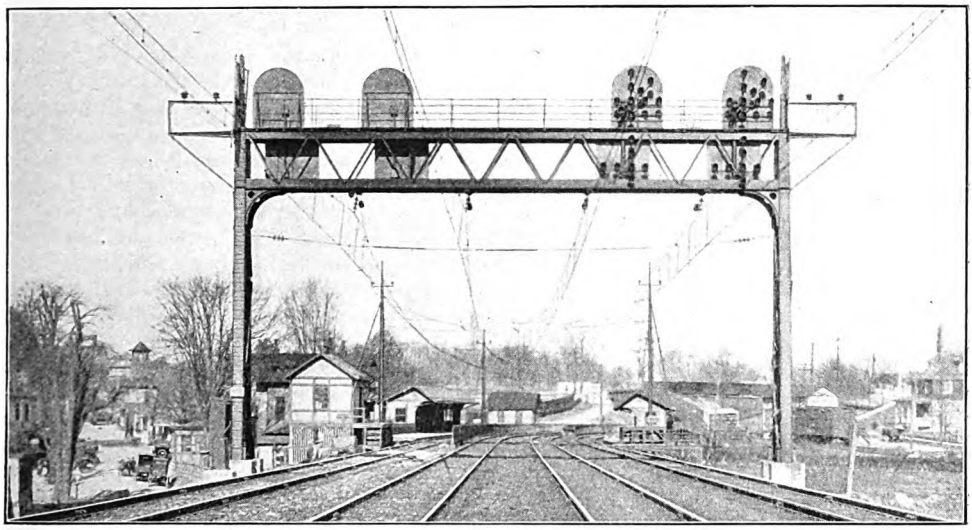

NEW "POSITION LIGHT" SIGNALS, PHILADELPHIA-PAOLI ELECTRIFICATION, PENNSYLVANIA RAILWAY.

Railway Electrical Progress and Practice.

TWO REMARKABLE AMERICAN RAILWAY ELECTRIFICATIONS. [No. I.]

By "INDICATOR."

SEVERAL exceptionally important electrification schemes have been carried out by various American railways recently, involving characteristics which place the respective installations in the front rank in regard to developmental aspects. One of these is the Philadelphia-Paoli suburban electrification, carried out by the Pennsylvania Railroad. The other is the Elkhorn Grade electrification of the Norfolk and Western Railway, mainly for freight traffic.

Dealing first with the Philadelphia-Paoli equipment, this work, estimated to involve a cost of about $4,000,000, relates to the suburban portion of the Pennsylvania Railroad main line from Broad Street station, Philadelphia, a four-track section of 20 miles carrying heavy local traffic. Expedition was, of course, a special factor; but almost as important was the need for dealing with traffic congestion problems. In fact, between West Philadelphia and Broad Street station the concentration of traffic made the work of construction a task of special difficulty. Through the "throat" of six tracks at the first signal cabin west of Broad Street, where fifty-five switches and fifty-two signals are located, 2,295 separate movements of trains and engines occur daily. Yet the work of equipment—including new signalling, as well as the erection of overhead construction—was carried out without interruption to the ordinary traffic. The entire work of electrifying this 20 miles of railroad involved the erection of 660 miles of electric wires, 760 poles, thirty-six signal bridges, and four power stations.

Between Broad Street station and Paoli there are nineteen stops in a distance of 20 miles. In order to maintain the present schedule, it has been necessary to use heavy and powerful locomotives with trains of three to eight cars, in order to enable trains to gain speed quickly after each stop, and to realise a favourable average speed. With the new electric trains there are the usual advantages of rapid acceleration, and increased loading capacity, while the simplicity of reversing is of special value at the busy Broad Street terminal. The greater ease of handling will not only reduce by about 15 per cent. the number of train movements

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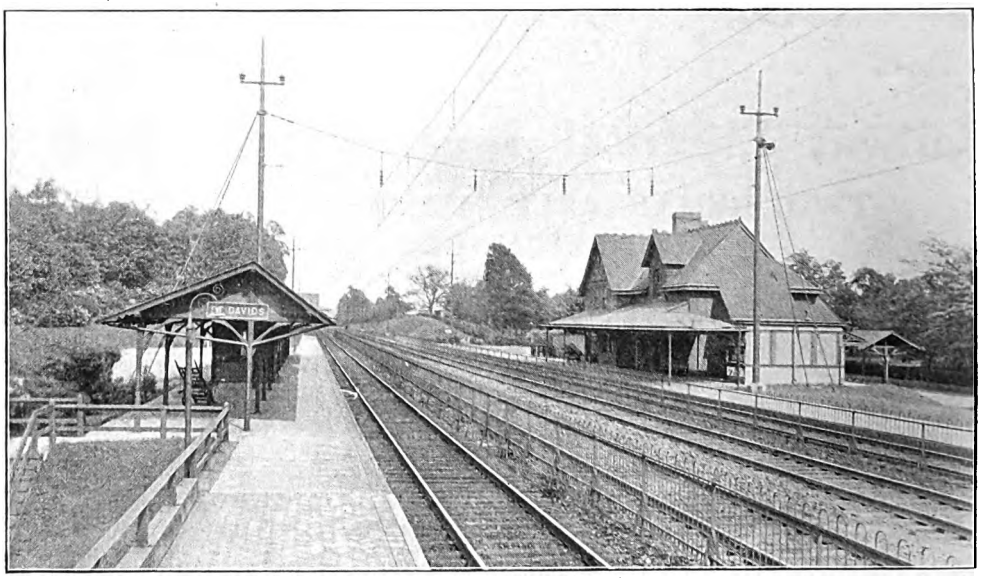
through the approach tracks during the rush hours, but will also greatly lessen the time during which the suburban trains occupy the terminal tracks in the station.

The overhead system was decided upon, in preference to the third rail, because it is better adapted to operation in complicated yards, and because it will lend itself more readily to such extensions as may be required in the future. The "catenary" system of conductors is employed, thus making the network of wires extremely flexible at all points, and keeping the contact to all intents and purposes exactly level, or, on grades, parallel to the track. This prevents destructive sparking at the contact devices on the trains, when running at high speed.

the wire system. It is expected that the contact wires will last about ten years.

Power is received from the Philadelphia Electric Company and distributed over the electrified section of line by means of four sub-stations located, respectively, at Arsenal Bridge, West Philadelphia, Bryn Mawr and Paoli. Current is delivered by the Philadelphia Electric Company to the Arsenal Bridge sub-station at 13,200 volts. It is there transformed to 44,000 volts, and carried in that form by the transmission wires. At the three other sub-stations the current is transformed down to 11,000 volts, which is the electric tension used on the trolley wires.

The new automatic block signal system installed on the electrified section is a



ST. DAVID'S STATION, PENNSYLVANIA RAILWAY.

In the system adopted by the Pennsylvania Railroad, a double trolley wire is suspended from the catenary. The upper wire, which hangs directly from the catenary, is of copper. Beneath it, and suspended from it by clips about 2 in. in length, is the second, or contact wire, which is of a hard, durable alloy, known as "phono-bronze." It is from this second wire that current is collected. The "phono-bronze" contact wire is shaped, in section, somewhat like a figure "8" the clips gripping the centre groove. When worn out, the contact wire can be removed from the clips, and a new one substituted with little difficulty, and without disturbing the remainder of

distinct departure from any other type of signals heretofore used by any railroad in America or elsewhere. This was referred to some time ago in the course of a paper read by Mr. A. H. Rudd, signal engineer, before our own Institution of Signal Engineers. It is claimed that the highest possible degree of safety and the greatest certainty and efficiency in operation, as well as economy in installation and in maintenance, are assured by the new signals. All moving parts have been eliminated from the signals themselves. There is no delicate machinery mounted on the signal bridges to get out of order or require attention. A most valuable feature

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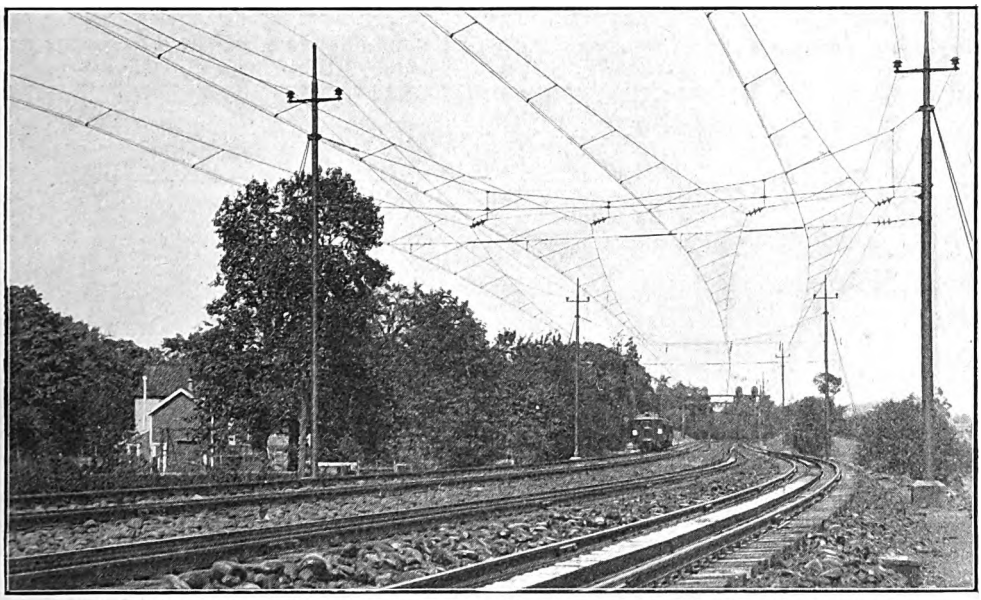
of the new system is that the same signals are used day and night. Colour plays no part in the scheme of the new signals, so that all possibility of failing to distinguish properly between red, white, and green lights at night is banished.

The principle of the new signals is the use, for both day and night, of rows of brilliant white electric lights, showing in sharp relief against a black background. These replace the moving arms of the semaphores used by day and the coloured lights used by night, in the ordinary forms of signal systems.

The lights of the new signals are so arranged that by lighting the proper row, any position of the semaphore arms—horizontal, diagonal, or vertical—can be indicated. Each signal is equipped with a sufficient number of lights to be the equivalent of two semaphore arms. To make the lights clearly visible, even against the brightest sunlight, the current used in the daytime is nearly four times as powerful as that used at night. With such distinctness do the lights stand out that they are easily seen, even in the brightest sunshine, for more than 4,000 ft. So brilliant are they that, when the full current is turned on at night, it is possible to read large type by them at a distance of 1,000 ft.

Each signal protects a block of track about 3,500 ft. in length. A train passing a signal automatically sets it at "Stop." The "Stop" signal is a warning that there is a train somewhere in the block beyond the signal. When the first train passes out of the block, the signal at the entrance to the block automatically changes to "Caution." A third position of the signal lights shows when two full blocks ahead are clear, and a fourth position when three or more blocks are unoccupied.

Under this arrangement, a motorman always receives notice of a possible "Stop" at least 7,000 ft. in advance, and always receives at least two cautionary signals before approaching a "Stop" or danger signal. The new signals are mounted on structural steel bridges which span the tracks and serve the additional purpose of "anchoring" the trolley wires.



GENERAL VIEW ON CURVE, SHOWING OVERHEAD EQUIPMENT OVER WATER-TROUGHS: PENNSYLVANIA RAILWAY.

The cars introduced for this service are identical, save for their motor equipment, with the type of all-steel passenger cars adopted several years ago by the Pennsylvania Railroad for use on its suburban lines. Having a length of 54 ft., the cars will seat 72 passengers each. The motorman's compartment is simply the front platform with the door closed. The controller and brake, when the platform is open, are concealed behind a false door.

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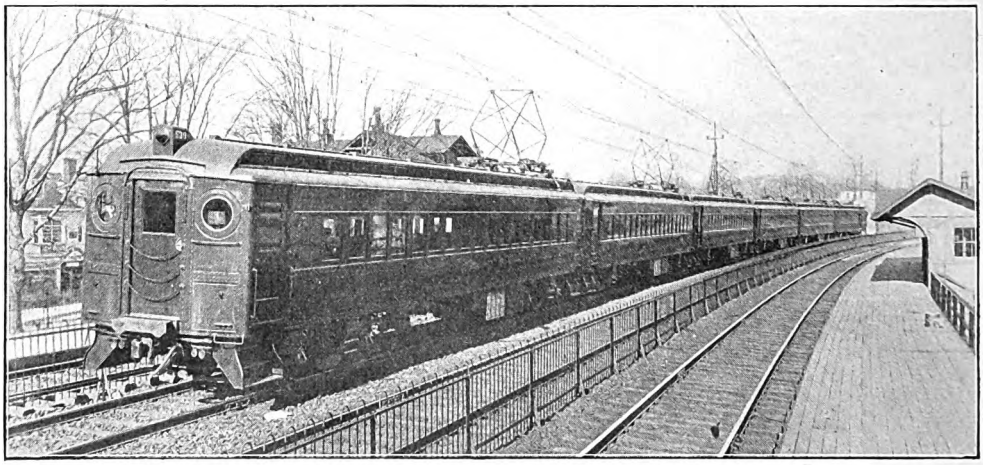
Pantagraph collectors are employed, carrying steel shoes about 4 ft. long and 4 in. broad, slightly rounded at the top. This shoe, which stands at right angles to the direction of the car, presses against the lower side of the contact wire, serving the function of the wheel on a trolley pole. It has the advantage of never running off on curves, owing to its width, and, strangely enough, of wearing the wire less than a wheel. The shoe is made of soft steel.

Every car can be operated in either direction, from either end, at four different speeds. By pressing a button the motorman can cause the pantagraphs on all cars to shoot upward and make contact with the wire. Pressing another button causes them to fall. Moving a small lever throws on the air brakes, simultaneously, on every car.

Men selected for the duty of motormen—all of them experienced enginemen on steam locomotives—and also those employés picked for conductors and brakemen in the electric service, were given thorough practice in the actual operation of test trains run between Overbrook and Paoli.

In addition to the instruction required by the Company, some 300 employés have voluntarily enrolled in a practical railway electric class, conducted under the auspices of the Pennsylvania Railroad Branch of the Young Men's Christian Association, at the main building, Forty-first Street and Westminster Avenue, Philadelphia. Included among the students are 80 enginemen and 28 firemen.

During installation strong scaffolding, erected on flat cars, was used to get the men up to the level of the wires with which they were working. Large gangs of men were employed in order that they could work very quickly during the limited time they were permitted to occupy a track in this manner.



ELECTRIC TRAIN, PHILADELPHIA-PAOLI SECTION, PENNSYLVANIA RAILWAY.

The air brakes are of the new "electrically-actuated" type, which the Pennsylvania Railroad has recently adopted. This device permits the quickest possible simultaneous application of the brakes throughout the train, and results in the smoothest and quickest stops.

In order to have a capable staff ready to handle the electric trains, as well as to create a reserve of trained employés which can be drawn upon at any time, upward of 600 men have been undergoing a special course of instruction. Two instruction cars were fitted up, one at Broad Street station and the other at the West Philadelphia shops. Every man assigned to the electric train service, or to the reserve, was required to pass an examination on the operation of the new trains.

Dealing now with the Elkhorn Grade electrification, this constitutes an important example of the working of heavy mineral traffic electrically, passenger traffic being quite incidental. The electrified section of the Norfolk and Western Railway, known as the Elkhorn Grade, is located on the main line in the southern part of West Virginia, about 105 miles west of Roanoke, and extends from Bluefield to Vivian, a distance of about 30 miles. The section is double track throughout, except in the Elkhorn tunnel, which is single track. There is also a large amount of third track, with passing

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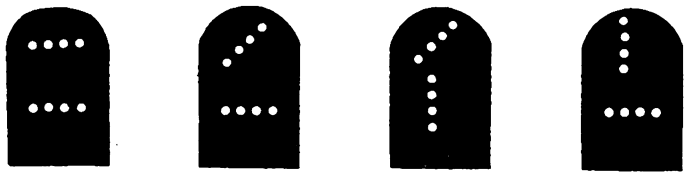
sidings and branches into the coal workings, and yard trackage. The grades on the line are heavy, varying from 1 in 100 at the west end to 1 in 75 and even 1 in 50 up the grade to and through the summit tunnel, a distance of about 10 miles. Thence the line descends on a 1 in 40 grade for about a mile, rising again at the ruling rate of about 1 in 400 for 10½ miles, and finally up a 1 in 85 per cent. grade for 3 miles to Bluefield. Fully 60 per cent. of the line is on curves, the maximum being about 12 deg.

The electrification of this section of the railway is primarily for the purpose of collecting from the mine sidings and yards in the coalfields the entire eastbound coal tonnage and transporting it up the grades and over the summit to the classification yard at Bluefield. From Bluefield, after classification, it is shipped east to the various destination points, chiefly to the Norfolk and Western's marine shipping pier at Lamberts Point, near Norfolk, Va. All coal traffic originates west of Flat Top, about 6 miles east of the summit of the heavy grade, and although much of the coal goes west the easterly shipments are very heavy and this constitutes the chief load handled electrically. Some coal originating east of the summit is shipped to the West, and this is also handled by the electric service to yards near the westerly end of the electrified section.

There are numerous colliery sidings throughout the coalfields, and the electric service includes the collection of loaded cars or trains from these sidings on the eastbound trip and the delivery of empties on the return trip. It will thus be seen that the electrified section is practically a local switching and short haul division between the coalfields and Bluefield, operated to a large extent independently of the other traffic of the main division. In addition to the heavy tonnage coal train service, however, through merchandise freight and passenger traffic over the electrified section, which is still handled by steam road engines, is also handled in part by electric engines which are used as pushers or helpers up the grades.

A main object of the electrification was to increase the capacity of the railway by materially reducing the time required to handle trains and to provide a more economical and efficient service over the heavy grades. To this end the heavy freight trains are handled with electric locomotives at a running speed up the grades of 14 miles per hour as compared with about 7½ miles per hour under steam operation; and a further saving in time is also effected by the elimination of the delays steam trains have heretofore occasioned by occupying the tracks while the engines take coal and water, one at a time, at the several coal and water stations on the grade. The effect of increased speed is especially marked at the single track Elkhorn tunnel, 3,000 ft. long on a 1 in 75 grade, where on account of ventilation requirements, it has been necessary under steam operation to reduce the speed up grade in the tunnel to about 6 miles per hour. This entails about 7 min. to clear the block, whereas under electric operation this movement is made in about 3 min.



INDICATIONS OF "POSITION LIGHT" SIGNALS: PENNSYLVANIA RAILROAD.

The heavy coal trains, handled in this service, weigh 3,250 tons and have formerly been handled up the grade by three steam locomotives, a road engine and a helper, being used over the entire section, and the third, serving as a pusher up the 1 in 75 and 1 in 50 grades, and being cut off at the summit. These steam engines are of the Mallet type fitted with mechanical stokers and superheaters. Under electric operation a single road engine is used over the division and a second electric engine is used as a pusher up the 1 in 75 and 1 in 50 grades. Thus it will be seen that one electric engine takes the place of two Mallets over the division, or two electric engines take the place of three Mallets up the grades and handle the train at approximately double the speed. The speed at which the electric locomotives handle the trains on the 1 in 250

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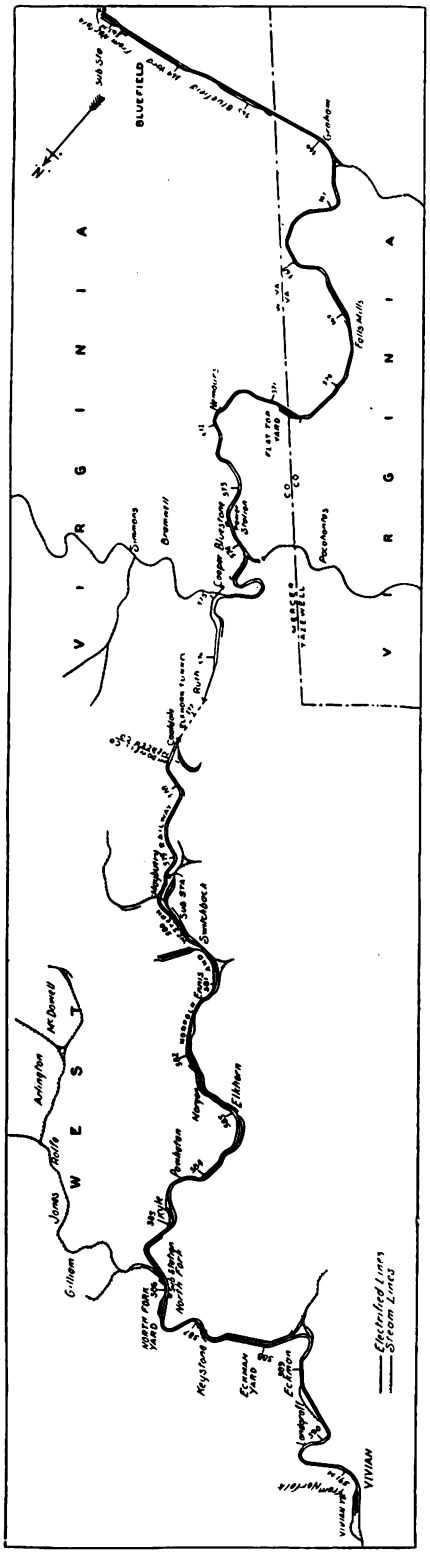

Map of Electrified Section of Norfolk & Western Railway

grade between Cooper and Graham is 28 miles per hour.

Another condition favourable to electric traction is the fact that trains may be despatched at fairly uniform intervals throughout the day, and thus desirable loading conditions on the power system are obtained, and at the same time the full service is handled with a moderate number of locomotives, each making a number of round trips per day.

The electrical installation is laid out and power plant, locomotives and other equipment provided for handling 20 full load trains, or 65,000 tons, a day eastbound over the division, with ample provision for additional traffic and extensions when required. The number of these trains handled per day at present is about 12, in addition to which pusher and helper service is provided for through freight and passenger trains.

The single-phase system of traction is used, power being generated, transmitted and distributed single-phase at 25 cycles and collected from the overhead catenary trolley contact system at 11,000 volts. The locomotives, however, are unique in that they are equipped with phase converters, which, in connection with the main step-down transformers on the locomotive, transform the single-phase power of the trolley to three-phase power for use in the three-phase induction type traction motors. Thus, while retaining all the advantages of high voltage single-phase distribution and collection, the advantages of three-phase induction motors for these heavy traction mountain grade conditions are also secured.

Another characteristic feature of the installation is the fact that as the result of the use of traction motors of the polyphase induction type it is feasible without the use of additional or complicated apparatus and devices to utilise the locomotives for electrically holding or braking the trains at constant speed while descending grades. This utilises the energy in the moving train descending the grade to drive the motors as generators and thus return energy to the line. On the Elkhorn Grade the conditions are such that the full advantages of this form of braking can be secured in that the trains are very heavy, the grades are severe, and the speeds are relatively high. The performance of this feature of the installation has proven highly satisfactory under operating conditions, the heaviest trains being handled down the mountain grades with a

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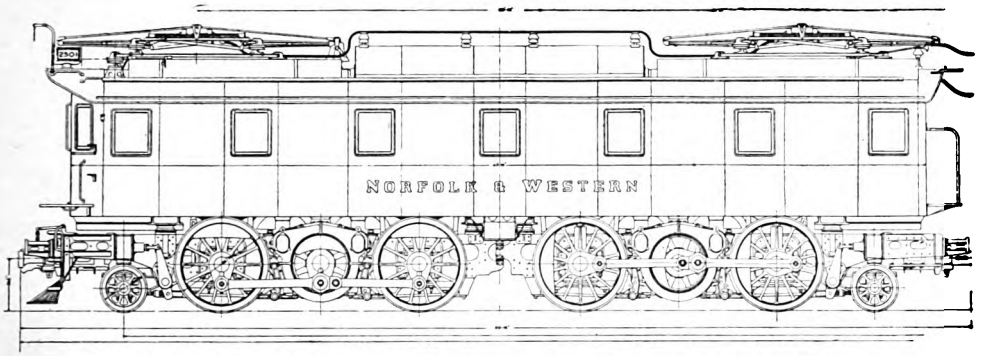


LOCOMOTIVE USED FOR NORFOLK AND WESTERN ELECTRIFICATION.

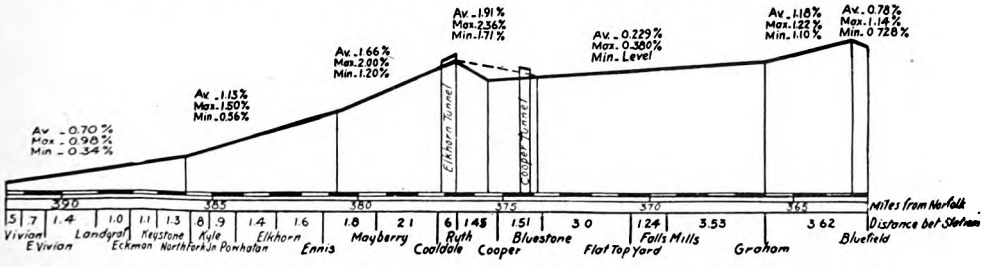
single engine at a uniform speed of about 15 miles per hour with ease, the air brakes being held in reserve for bringing the train to a standstill when required. This results in a large reduction in the wear on brake shoes and wheel tyres and wear and tear on draft gear and on the cars and locomotives generally.

In addition to the direct advantages and savings resulting from the electric train service, the railway has taken advantage of the presence of an adequate power supply at net cost of generation for the operation of various auxiliary plants. Thus a large steam pumping station at Bluestone for the water supply for steam locomotives has been shut down and the pumping is done at the electric power station located near by, and the fans for ventilating the Elkhorn Tunnel will now be driven by electric motors. Likewise electric power will also be ultimately used for operating shops and pumps at Bluefield and several other points on the division.

High tension power is transmitted at 44,000 volts, 25 cycles, single-phase. The wires are carried on catenary supports, except at the tunnels, where the line goes above ground over the summits. All power is obtained from transformers which step down the voltage from 44,000 to 11,000 volts. These are housed in suitable buildings. One of the sub-stations is located in the transformer and switching house at the power station. Sub-stations are located at Bluefield, Bluestone (power house), Maybeury, North Folk, and Vivian.

The oil circuit breakers in the sub-stations are remote-controlled, and will be operated from adjacent signal towers or passenger stations, or at the yard master's offices, thus requiring no attendance. Power at 440 volts for the operation of the oil circuit breakers is obtained from two step-down transformers, one connected to the 11,000 volt bus and one to the 440,000 volt bus. The transformers are of the Westinghouse single-phase, oil-insulated, water-cooled type, with primaries wound for 44,000 volts and secondaries for 11,000 volts. They are equipped with thermostats which at high temperatures close a bell alarm circuit to the nearest operator's office. Two transformer oil filter outfits have been provided—one for the power house and one for the sub-stations. The latter outfit is transferred from one sub-station to another as required.

One advantage of using a very high voltage on the contact system is that no supplementary feeders are required, the distribution of power from sub-stations being



GRADIENT PROFILE, ELKHORN GRADE, NORFOLK AND WESTERN RAILWAY.

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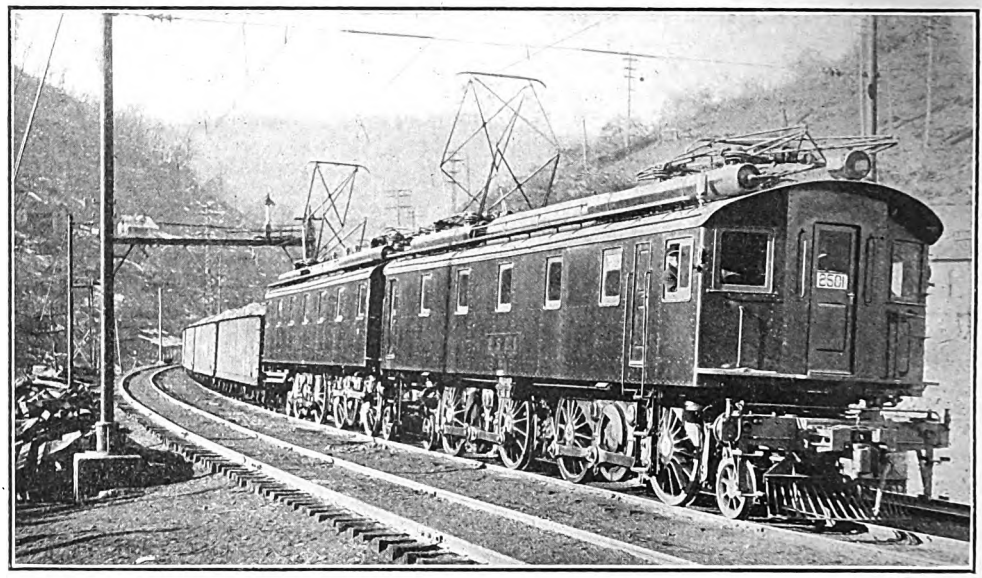
effected entirely by means of the trolley lines proper.

There are two distinct types of structures used for supporting the system of catenary or trolley lines; one, which is used on the main line, where the wires are suspended from overhead beams or girders, and the other, used in yards, where an overhead cross-catenary cable is used to support the longitudinal catenary wires of a large number of tracks. In the Elkhorn Tunnel special catenary construction was necessary. This is a single track tunnel, 3,000 ft. long.

The arrangement adopted was to have a supporting structure every 75 ft. apart. At each side of each structure two cast iron brackets held to the brick lining of the tunnel by large bronze expansion bolts, each carry a 44,000 volt transmission line insulator. A 2 in. brass pipe is carried parallel to the tracks by the pair of insulators on each side. Another line insulator on each side is mounted by bronze castings at the middle of these pipes and a cross pipe bent to follow the arch of the tunnel, forms the support for a bronze messenger wire. The live catenary parts have, therefore, double 44,000 volt insulation to ground. Despite the necessarily very limited clearances, the work in this tunnel stood a test of three times normal trolley voltage and has so far performed very satisfactorily for the several weeks it has been in service.



DOUBLE-HEADED MINERAL TRAIN ON ELKHORN GRADE.

(To be continued.)

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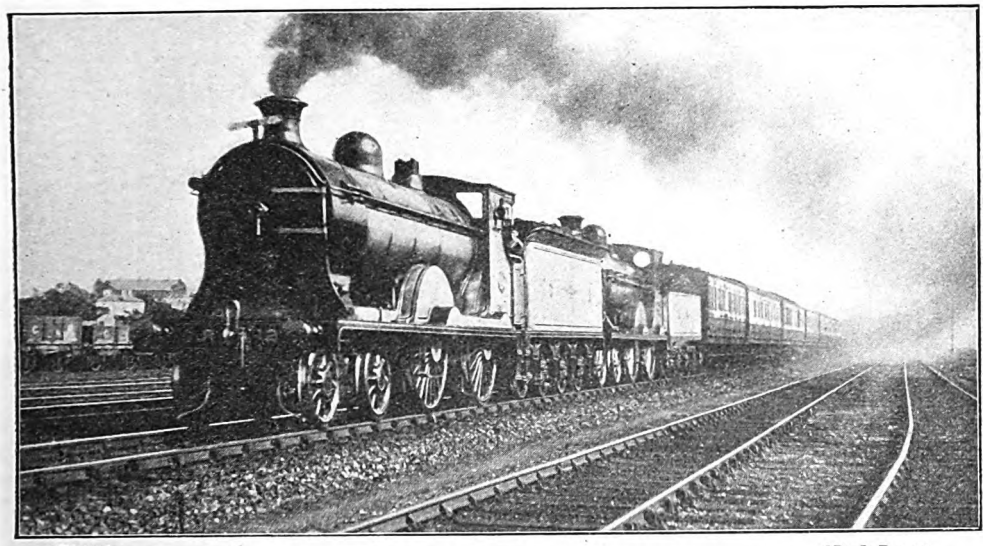

Photo] [*R. J. Purves.*

CALEDONIAN RAILWAY.

10.0 a.m. down Scotch express near Kingmoor. 4–4–0 engines Nos. 121 and 900. (Note.—No. 121 was the engine of the troop train in the Quintinshill accident.)

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

IN this country we are often accused of conservatism in that so much of our express traffic is still worked by 4–4–0 locomotives. But analysis of the conditions shows that such accusations of conservatism cannot usually be supported, and the general favour of the 4–4–0 type is largely explainable on other grounds. The examples described last month of remarkable work done by such engines, notable as they were, afford only an indication of the class of performance for which they are daily responsible all over the United Kingdom.

The density of population in this country, and the consequent circulation of passengers and merchandise in every direction, call for frequency of service rather than an intermittent service of very heavy trains. Rolling stock has been designed on much the same principle, both passenger and goods vehicles being of comparatively light construction and limited capacity with a view to dealing with small movements and fluctuations of traffic rather than heavy and constant loads. Under these conditions the 4–4–0 express engine for passenger traffic, and the 0–6–0 for goods working, with their moderate tractive power, have become practically standard in these islands, still being employed for the working of the major proportion of trains in each department.

Agreements between railway companies, and various working arrangements and the like have caused many competitive passenger trains to disappear, and, as train services have settled down into "grooves," train-loads are beginning on many lines to assume a consistently heavy character that has occasioned the construction of many large 4–4–2 and 4–6–0 express locomotives to meet the altered conditions. But even with allowances for trains justifying these powerful engines, there is still plenty of express passenger work that can be, and is, efficiently performed by engines having the 4–4–0 wheel arrangement. Further, one result of the abnormal conditions which now apply, with civilian traffic almost as heavy as it was, though different in character, military traffic added in considerable volume, and fewer trains to relieve

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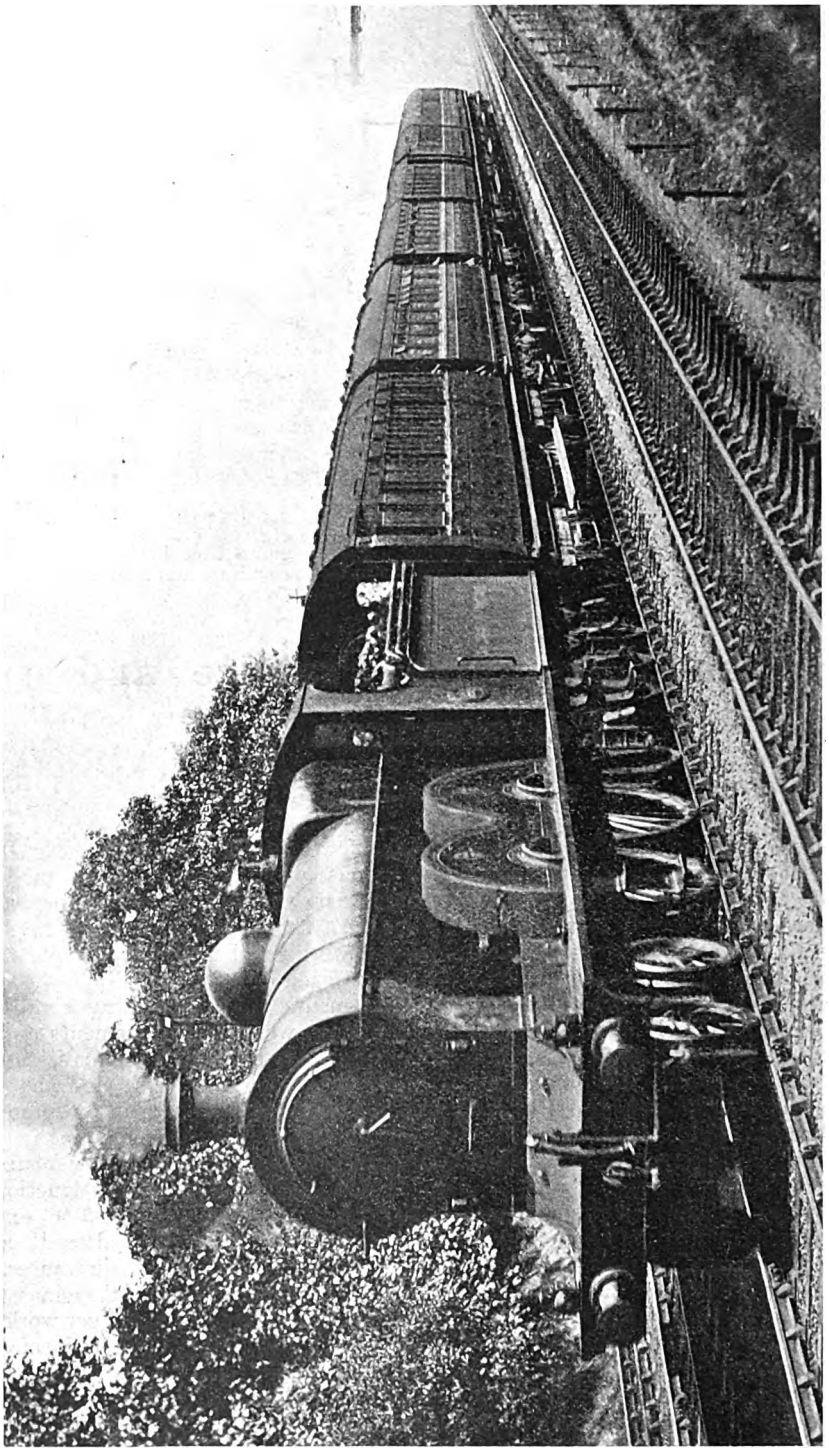

Photo] [F. E. Mackay.

LANCASHIRE AND YORKSHIRE RAILWAY.

Leeds and Bradford to Liverpool Luncheon Car Express, passing Hebden Bridge.
"Atlantic" Locomotive No. 1424.

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the resulting pressure, is that the 4–4–0 engines on most lines are doing even more exceptional work than usual, and doing it well.

It is worth while briefly to examine the position of the 4–4–0 express engine in the British Isles before considering further examples of its work. Only two of the large English lines now rely on this wheel arrangement exclusively for express passenger service—the Midland and the South Eastern and Chatham — and, curiously enough, neither of these companies aspires higher than the 0–6–0 type for goods and mineral trains. The case of the Midland is the more curious in that this partiality for locomotives of comparatively moderate power for every class of service leads to very extensive piloting—more extensive, indeed, than on any other line. In Ireland, also, the larger companies have, up to the present, employed only the 4–4–0 wheel arrangement on express trains, although the Great Southern and Western Railway now has 4–6–0 engines building.

On certain other lines 4–4–0 engines hold almost exclusive sway, as on the Caledonian Railway, where the total number of large-wheeled 4–6–0 express engines in use is only eight, and the North British Railway, whose large 4–4–0 engines perform the major part of the express work on all sections of the main line save Edinburgh–Aberdeen. Large superheater 4–4–0 locomotives of the "Director" class have practically replaced the "Atlantics" on the important duties of the London Extension of the Great Central Railway, which provides the hardest locomotive work on that system. On various other railways, as the London and North Western, London and South Western, North Eastern, Great Eastern, and London, Brighton and South Coast lines, 4–4–0 engines take turns with larger 4–4–2 and 4–6–0 locomotives on even the hardest duties, and, beyond certain restrictions of load, which often work out in practice as more nominal than real, frequently appear to do just as well. On the two first-mentioned lines of this quintette this interchangeability is quite notable, and it would be very interesting to ascertain the comparative fuel and maintenance costs of the 4–4–0 as against the 4–6–0 engines, were such figures available. On the Great Western, Great Northern, Lancashire and Yorkshire, and Glasgow and South Western Railways 4–4–0 locomotives are now rather infrequently entrusted with the more important express duties, although when circumstances compel their use—as, for example, in the case of the Great Northern 4–4–0 engines whose work was described in the last issue—it would often be difficult for the lay observer to decide from the train that the hauling power at the head of it was anything out of the ordinary.

In order to extend our survey, we will now take some further examples of 4–4–0 performance, commencing with the Great Eastern Railway, whose locomotive work has not now occupied our attention for some time past. I am indebted to several correspondents for details received recently of runs on the Great Eastern Railway, and although considerations of space will not allow me to deal with the whole of these, I will describe the more noteworthy of them. But first a few words in connection with the recent modifications of the Great Eastern timetables, which are in some respects inclined to be momentous. I wonder how many readers have noticed the fact that the long-standing "Cathedral Route" from Liverpool Street to York is now a thing of the past so far as through trains are concerned? The four remaining expresses over the Great Northern and Great Eastern Joint Line, two in each direction daily, are now arranged primarily to give connection between important towns in the Eastern Counties and the North of England. One of these trains—the 4.35 p.m. *ex*-York—certainly does run through to Liverpool Street, but as a wait of 26 min. at March is included in its schedule, the through working is evidently only a matter of convenience in the movement of the rolling stock, and to meet the needs of intermediate places requiring through facilities. Beyond this the times of the trains on the Cambridge line return very largely to those in operation before the revolutionary changes of October, 1914. The 8.52 a.m. down again starts at 8.40 a.m., the 12.25 p.m. at 12.0 noon, and the 3.0 p.m. at 2.35 p.m., the original stops and slips being re-inserted. From London to Bishop's Stortford the fastest time becomes again 43 min., while it is surprising to find the allowance of 31 min. thence to Cambridge, which has operated since 1906 and has been observed with ease, increased to 33 min. In the reverse direction a corresponding increase of 2 min. has been made to the booking of all trains from Cambridge to Bishop's Stortford, but this is more reasonable, as with heavy trains the climb to Elsenham summit is inclined to be toilsome, and the 4–4–0 engines found some difficulty as a rule in covering this 25¼ miles' length in 33 min. The Bishop's Stortford

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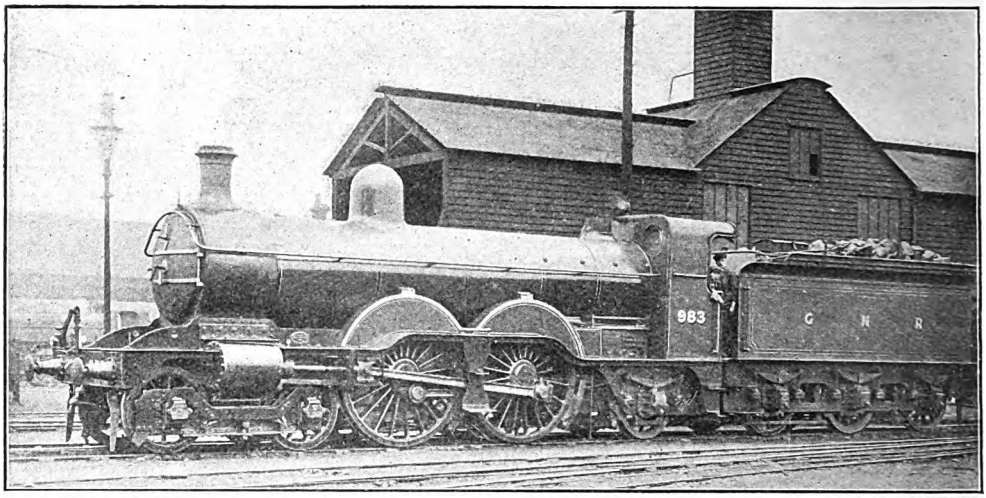

Photo] [*W. J. Reynolds.*

GREAT NORTHERN RAILWAY.

Small "Atlantic" engine No. 983, fitted with outside bearings to the bogie wheels.

–Liverpool Street times have also been increased, from 39 and 40 to 42, 43, 44, and even 45 min. in some cases for the 30·4 miles' journey. For a stretch of line of which the first 25 miles are all either on falling grades or fractionally easier than level, these are decidedly easy times, as it is practicable, under normal circumstances, to pass Tottenham, 24·3 miles, in 27 or 28 min., and to reach Liverpool Street in 38 to 40 min.

Similar decelerations appear on the Colchester line, although, strangely enough, the most difficult and rarely observed booking—that of 22 min. from Colchester to Ipswich—is still retained. But the non-stop time of 84 min. from London to Ipswich is increased to one of 86–90 min., while that in the reverse direction is now 86–88 min. Colchester, previously 65 min. distant from Liverpool Street on the down journey, and 62 min. on the up, has its non-stop times increased to 66–68 min. and 67–70 min. respectively. And the smart non-stop times of 56 min. from Ipswich to Norwich, and 54 min. in the reverse direction, have been increased to as much as 59 min. each way, although these trains do not load usually to more than six or seven bogie vehicles.

These changes are a little disappointing, as the speeds of October, 1914, were not beyond the tractive capacity of the engines—indeed, they were the standard summer times even before any 4–6–0 engines had made their appearance—but of course the necessity for such decelerations must be attributed only to the present conditions, which have compelled similar measures on other large lines: as, for example, the London and North Western Railway. That punctuality, which has been so characteristic a feature of Great Eastern working in past years, has certainly now been restored to its wonted level, and, further, it will without doubt be conceded that the present service is a great advance on the winter service in force prior to 1914, but still we may hope that the bookings first standardized in the "radical alterations" of last October will again materialize when we come to happier and more prosperous times than the present.

But now for some details of Great Eastern Railway locomotive work, as showing what can be done when necessary. I will take the Cambridge line runs this month, as they were made mainly with 4–4–0 engines, leaving those on the Colchester line till later, when I hope to deal with the work of 4–6–0 engines.

Out of eleven down runs sent by one correspondent I choose four of special merit. On the first of these No. 1014—one of the 2–4–0 T19 class batch rebuilt without bogies and not inaptly nicknamed "Humpty Dumpties"—had charge of the original 8.20 p.m. *ex*-Liverpool Street, allowed 44 min. to Bishop's Stortford and 32 min. thence to Cambridge. With a by no means inconsiderable load No. 1014 did not do badly, gaining 2½ min. (net) on the first stage and ¾ min. on the second, but the times do not call for any special comment. The

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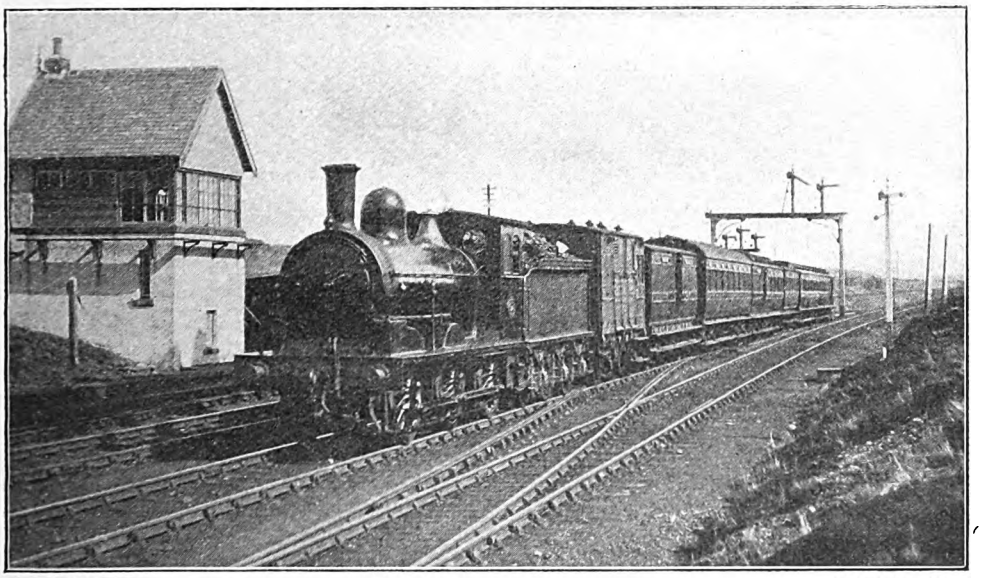
work of No. 713—a 4-4-0 rebuild of the same class—was much finer, the time of 20 min. 40 sec. from Tottenham to Harlow involving an average speed of 53·4 miles per hour, despite the gradually rising grade. Beyond Stortford, also, there was some very smart running, the time from the start to Elsenham, which includes 3 miles commencing at 1 in 232 and 209, and finishing at 1 in 132 and 107 for over a mile, being the smartest of the whole series. But for a signal check outside Cambridge, the latter run would have been made in 29 min., so that, allowing for delays, No. 713 had as much as 7½ min. to her credit at the close of the journey. This would be equivalent to a non-stop time of about 67 min. The finest run of this series was that on the now suspended 11.5 a.m. *ex*-Liverpool Street, which afforded the fastest start-to-stop time to Stortford that I have ever yet seen recorded. 12 min. 5 sec. from Tottenham to Broxbourne in particular was quite a good time. Beyond Stortford, however, nothing very startling was done, although the aggregate gain on schedule time—43 min. to Stortford and 31 beyond—was 6¼ min. Load considered, the run on the 5.13 p.m. Hunstanton "diner" was also excellent. To Stortford 3 min. were gained, and then by faster running than usual north of Audley End a further 1¾ min. to Cambridge, the 10·7 miles from Audley End to Shelford being covered in 9 min. 40 sec.

In the next three columns are seen my three latest down runs on the Cambridge line, in each case on the newly-reinstated 8.40 a.m. *ex*-Liverpool Street. The collection of engines involved is interesting, No. 1794 being one of the two original Schmidt superheater "Claud Hamilton" class engines, No. 1791 of the same type, with the Weir feed-water heater and feed-pump equipment, while No. 1826 has no other special feature than the top-feed arrangement, with which it was the first Great Eastern Railway engine to be fitted. As far as Stortford the three runs were inclined to be depressing in the modesty of their speed achievements, but beyond there good work was done. An excellent start, for example, was made from Stortford in the first case, speed not falling below 37·5 miles per hour on the final 1 in 107 approaching Elsenham, while maxima were recorded of 66 miles per hour at Newport, and 72·5 beyond Great Chesterford. Thereafter the engine was eased to avoid too early an arrival, but even then 2 min. 40 sec. had been gained on the new 33 min. allowance. No. 1791 did not do so well up to Elsenham, falling to 31·9 miles per hour on the ascent, but after a speed of 70·3 miles per hour had been attained at Chesterford, it was maintained well on to Shelford, and Cambridge was reached 2¼ min. early. On the third



Photo] [*R. J. Purves.*

NORTH EASTERN RAILWAY.

Darlington-Tebay train at Stainmoor Summit (1,378 ft.), 0-6-0 engine No. 1075.

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run No. 1826 did very well beyond Stortford, speed not falling below 39·1 miles per hour on the 1 in 107 up to Elsenham—a very respectable figure for a 4-4-0 engine hauling 245 tons—and the time to Chesterford was nearly as good as that of No. 1794. But the maximum speed touched here was only 65·2 miles per hour, so that we took 30 min. 35 sec. to reach Cambridge. Despite this, however, the arrears of time on the earlier part of the journey had more than been regained. It is rather curious that the times between Tottenham and Stortford on these three runs on the 8.40 a.m. down do not vary by more than 10 sec.

including ½ mile at 1 in 304, and a mile at 1 in 232, the speed just touched 50 miles per hour, after which it dropped to 37·5 on the steepest part—1 in 107—of the ascent. Elsenham was passed in 8 min. 46 sec. Then followed a remarkable speed exhibition, the 20·1 miles from Elsenham to Cambridge (South End Box) being covered in 18 min. 27 sec., while of this distance the 11·9 miles from Littlebury Box to South End Box only occupied 10 min. 18 sec.—an average of 69·3 miles per hour. Audley End was passed in 14 min. 48 sec. from the start, Chesterford in 18 min. 35 sec., Shelford in 24 min. 21 sec., and Cambridge was reached in 28 min. 2 sec.,

TABLE A—G.E.R., LIVERPOOL STREET-CAMBRIDGE.

Distance.	Train	‡ 8.20 p.m.		‡11.5 a.m.	‡5.13 p.m	8.40 a.m.		
	Engine No.	1014	713	1792	1843	1794	1791	1826
	Type	¶2-4-0	¶4-4-0	4-4-0	4-4-0	§ 4-4-0	‖ 4-4-0	4-4-0
	Load (axles)	52	48	44	49	39	45	43
	Load (tons)	*290	*260	290	330	†245	†275	†275
Miles.		M. S.	M. S.	M. S.	M. S.	M. S.	M. S.	M. S.
0·0	Liverpool St. .. dep.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		a	a			a	a	a
6·1	Tottenham .. pass	12.35	12.25	11.40	11.55	12.40	13.10	14.35
12·8	Waltham .. ,,	21.05	20.25	19.10	19.35	21.10	22.00	23.00
17·1	Broxbourne .. ,,	26.20	25.10	23.45	24.20	26.15	27.00	28.25
24·5	Harlow .. .. ,,	35.20	33.05	32.10	32.35	35.05	35.40	37.20
			b					
30·4	B'ps Stortford { arr.	42.25	42.25	38.55	39.55	42.50	43.15	44.35
	B'ps Stortford { dep.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5·2	Elsenham .. pass	9.25	8.38	8.55	9.10	8.45	9.25	8.55
11·3	Audley End .. ,,	16.15	14.57	15.25	15.45	15.20	16.10	15.25
15·3	Gt. Chesterford ,,	20.25	18.55	19.25	19.35	19.20	20.15	19.25
22·0	Shelford .. ,,	27.05	25.05	25.40	25.25	25.40	26.20	26.05
			c					
25·3	Cambridge .. arr.	31.15	30.45	29.45	29.10	30.20	30.45	30.35
30·4	net times { mins.	41½	39½	39	40	42	42	42
25·3	net times { mins.	31¼	29	29¾	29¼	30¼	30¾	30½

¶ Re-built T19 class. § Superheater. ‖ Feed-water heater. ‡ Old time-table.
* Less 15 axles = 45 tons, beyond Broxbourne (slip portion).
† Less 6 axles = 30 tons, beyond Broxbourne; less a further 6 axles = 30 tons, beyond Audley End (slip portions).
a Signal checks, Hackney Downs. *b* Signal stop, Spelbrook Box. *c* Signals approaching Cambridge, severe.

Before leaving the down direction of running, I might mention the details of a journey on the 12.0 noon "West Norfolk" luncheon car express *ex*-Liverpool Street, sent by another friend, as this run has some remarkable features. The engine was a 4-4-0 rebuild—No. 719—and the load 34 axles, or 230 tons in all. Showery weather and a south-west gale hampered the running. Checks south of Stortford spoiled the early part of the run, but from there a noteworthy effort was made to regain the arrears of time. On the slightly rising grades to Stansted,

a clear gain of 3 min. on the time then in force, or 5 min. on that at present operative. The average start-to-stop speed was as high as 54·5 miles per hour. Such work for an engine with only 18 in. by 24 in. cylinders and comparatively limited steaming capacity was really smart.

Some up runs are given in table B, the first four being chosen from a selection of nine sent by my earlier correspondent. A "Humpty Dumpty" figures again in the first one—on the now defunct 1.23 p.m. from Cambridge to St. Pancras—and did quite

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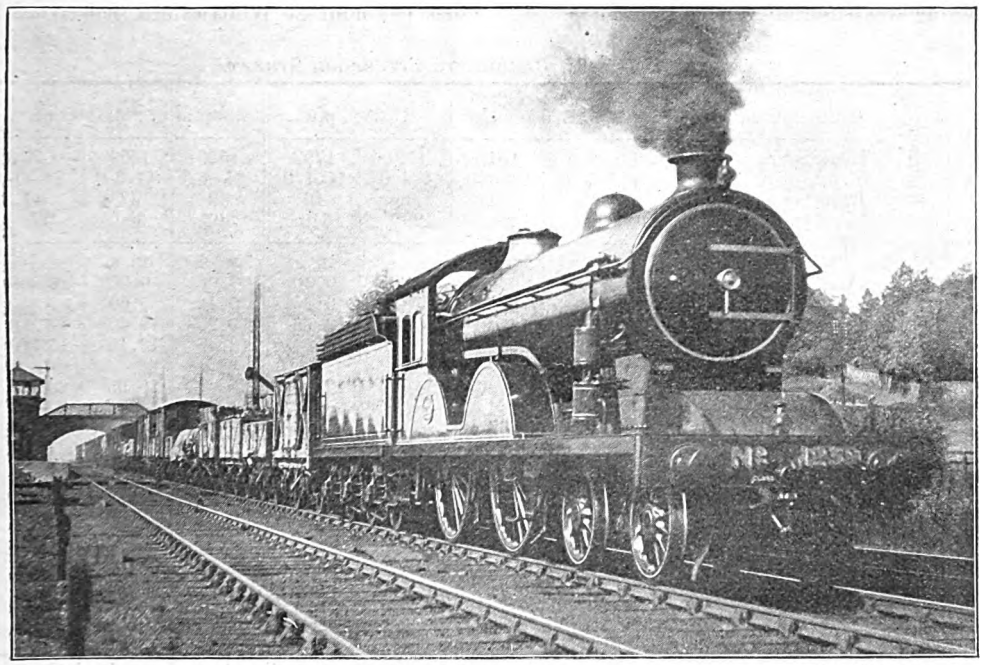
well, especially south of Stortford. From Cambridge to Audley End a somewhat sluggish start was made, but the time of 9 min. 10 sec. from there up to Elsenham was quite good. Consequently Stortford was reached in 34 min., and by the aid of an "Underground" stop lasting only 45 sec. the train got away again in under the 35 min. allowed from Cambridge. Thence to Tottenham some really fine running ensued, the 5·9 miles out to Harlow taking only 8 min. 35 sec., and the 18·4 miles thence to Tottenham, despite easy running beyond Waltham, 17 min. 55 sec. No. 1016 in the next run, with a heavier load, did even better, improving on 762's time to Audley End, and, although rather slower up to Elsenham, reaching Stortford in 33 min. 25 sec. Thence to Harlow the times tie, but after that No. 1016 fell behind No. 762 to the extent of 30 sec. to Waltham, regaining 15 sec. by a continued effort to Tottenham. The net times I have given on these two runs are into Liverpool Street; the actual times to the next stop—Kentish Town—were 37½ min. from Stortford (29·6 miles), or 36¾ min. net, on the first run, and 37¼ min. on the second. Following this are two runs on the 1.33 p.m. *ex*-Cambridge, at that time non-stop from Cambridge, but now leaving at 12.58 p.m., and calling at Stortford. On the first No. 1791, not then equipped with the Weir attachments, did rather poorly to Stortford, but was then responsible for some fine work to Tottenham, covering the 24·3 miles from Stortford in 24 min. Conversely, on the second journey No. 1793—the other of the two Schmidt superheater engines previously mentioned—with a much heavier load, did better work to Stortford, but took matters more easily thence to Tottenham.



Photo] [*R. J. Purves.*

NORTH EASTERN RAILWAY.

2.50 p.m. *ex*-Forth Goods station express goods train passing Low Fell.
Large 4–4–0 engine No. 1239 (class R 1).

The foregoing runs represent the work of the 4–4–0 engines at their best, and the contrast between these times and those in the next column is therefore the more striking, as showing the greatly increased tractive capacity of the 4–6–0 engines as compared with the 4–4–0's. No. 1520 engine, which figured in a run described in these columns recently (on the 3.10 p.m. express from Liverpool Street to Ipswich), is, I find, driven by Fish, of Norwich shed, whose work is always most praiseworthy, and this run, for details of which I am indebted to the kindness of a friend, is no exception.

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Prior to that part of the run tabulated, No. 1520 had covered the 16 dead level miles from Brandon to Ely in 18 min. 24 sec., start-to-stop, running the first 14·6 miles in 16 min. 6 sec., and attaining a maximum speed of 66·6 miles per hour. This was with a load of 250 tons, but with the full load of 365 tons, the start-to-stop time from Ely to Waterbeach, 9·4 miles, was 12 min. 37 sec., and from Waterbeach to Cambridge, 5·3 miles, 9 min. 36 sec.—both commendably smart spurts with a heavy load. For these three runs the working time-table (that of October, 1914) allowed 20, 14, and 9 min. respectively. But south of Cambridge the running was superlatively good. The start, with a far heavier train, was much smarter than that made by any of the 4-4-0 engines, and when it is considered that the climb lasts unbroken from Shelford to Elsenham, but for 2 miles of downhill and level from Audley End to Newport, and includes $4\frac{3}{8}$ miles at from 1 in 135–176, with a further $6\frac{3}{8}$ at from 1 in 254–336, Fish's achievement in covering the 20·1 miles up to Elsenham in 25 min. 46 sec. with 365 tons must be reckoned a really remarkable one. In this way nearly $3\frac{1}{2}$ min. were gained to Stortford. Re-starting, some further magnificent running took place, the start being finer than, and the subsequent times equal to, the best of those with the 4-4-0 engines. The 18·4 miles from Harlow to Tottenham were covered in 18 min. 12 sec. Thus the net running times on each section of the journey totalled up to 69 min., equivalent to a non-stop time from Cambridge to London of rather less than 68 min.

Against these times those of two recent runs of my own, in the last two columns, pale somewhat, although they had some excellent features. In both cases the work from Cambridge to Stortford was quite good, $1\frac{3}{4}$ min. being gained on the first run, and time being kept on the second despite a very severe check at North Hall costing at least $3\frac{1}{2}$ min. On the first run we touched 52·9 miles per hour at Whittlesford, fell to 42·9 on the 1 in 135–149 beyond Chesterford, and after an intermediate maximum of 57·7 at Newport, went up the final length of 1 in 182–254–176 to Elsenham with no lower minimum than 40. On the second run, however, we touched 54·2 miles per hour at Whittlesford, and did not go below 46 at Littlebury; in fact, the time to Audley End was the fastest of the whole series, and with quite a substantial load. But beyond Stortford, the train being on time, and enjoying an allowance of 45 min. to Liverpool Street, we ran moderately up to town, and even then contrived to have a net time 5 min. under that booked. On a subsequent occasion, with No. 1516 and 300 tons, when

TABLE B—G.E.R., CAMBRIDGE–LIVERPOOL STREET.

Distance.	Distance.	Train *ex*-Cambridge ..	‡1.23 p.m.		‡1.33 p.m.		12.58p.m	3.51 p.m.	
		Engine No.	762	1016	1791	1793	1520	1509	1509
		Type	¶2-4-0	¶4-4-0	4-4-0	§4-4-0	§4-6-0	§4-6-0	§4-6-0
		Load (axles)	34	41	36	46	52	47	41
		Load (tons)	220	265	255	310	365	300	270
Miles.	Miles.		M. S.	M. S.	M. S.	M. S.	M. S.	M. S.	M. S.
0·0	0·0	Cambridge .. dep.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3·3	3·3	Shelford .. pass	6.40	6.20	6.00	6.00	5.49	5.50	5.40
10·0	10·0	Gt. Chesterford ,,	15.10	14.40	14.40	13.55	13.26	13.40	13.10
14·0	14·0	Audley End .. ,,	21.00	20.15	21.00	19.30	18.46	19.15	18.10
									b
20·1	20·1	Elsenham .. ,,	28.10	27.50	29.05	27.10	25.46	26.55	28.40
25·3	25·3	B'ps Stortford arr.	34.00	33.25	pass	pass	31.34	33.15	34.45
—	0·0	B'ps Stortford dep.	0.00	0.00	35.00	33.40	0.00	0.00	0.00
31·2	5·9	Harlow .. .. pass	8.35	8.35	41.00	41.05	8.24	9.00	8.25
38·6	13·3	Broxbourne .. ,,	15.30	15.50	48.00	48.20	15.28	16.30	16.10
42·9	17·6	Waltham .. ,,	19.30	20.00	52.15	52.45	19.50	21.15	21.05
49·6	24·3	Tottenham .. ,,	26.30	26.45	59.00	60.10	26.36	29.05	29.00
					a	a	a	a	a
55·7	30·4	Liverpool St. .. ,,	To St. Pancras		72.30	73.50	42.41	44.55	43.45
55·7	25·3	net times mins.	34	$33\frac{1}{2}$	70	$71\frac{1}{4}$	$31\frac{1}{2}$	$33\frac{1}{4}$	$31\frac{1}{4}$
	30·4	net times mins.	$37\frac{1}{2}$	$37\frac{3}{4}$			$37\frac{1}{2}$	40	40

¶ Re-built T19 class. § Superheater. ‡ Old time-table. a Signal checks, suburban district. b Severe signal check, North Hall.

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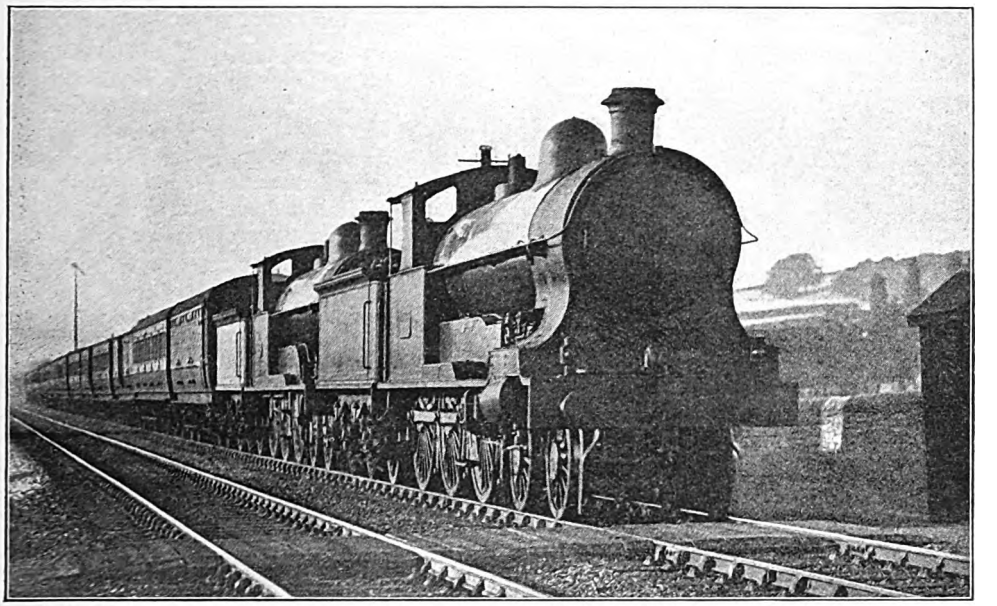
the train was 4 min. late in starting from Stortford, we passed Tottenham in almost exactly the same time—28 min. 55 sec., to be exact—and then, getting a clear road on to Liverpool Street, effected an arrival in 40 min. 5 sec. from the start, and a minute before time.

As an example of the capacity of the "Claud Hamilton" class engines with lighter loads, some logs on semi-fast trains between Norwich and Ely, forwarded by a correspondent, are of decided interest. The four runs given all relate to the 5 p.m. express *ex*-Norwich, on the old time tables, calling at Wymondham, Thetford and Brandon. On the first run No. 1839 had a load of 31 axles, or 215 tons, but experienced delays east of Wymondham. From there, however, the start-to-stop run of 20·3 miles to Thetford was made in 24 min. 10 sec.; from Thetford to Brandon, 7·2 miles—mostly downhill—in 9 min. 33 sec.; and from Brandon to Ely, 16 miles, 20 min. 40 sec. On the next run No. 1801 had a train of 39 axles, or 245 tons, and did splendidly. The 9·2 miles from Trowse to Wymondham, including the 4 miles of Hethersett bank, which are largely at 1 in 129–101, took only 15 min. 40 sec., after which the Wymondham–Thetford length was run off in the very smart time of 22 min. 50 sec. Attleborough, 5·6 miles, was passed in 8 min. 5 sec., after which the 10·5 miles to Roudham Junction were covered in 10 min. 10 sec. As previously mentioned, this is not a level stretch; between Wymondham and Thetford there are 7 miles of adverse grades, mainly between 1 in 200 and 1 in 250. From Thetford No. 1801 ran to Brandon in 9 min., but after that delays were experienced. No. 1885, on another occasion, with a load of 36 axles, or 230 tons, did even better from Trowse to Wymondham, covering this length in 14 min. 55 sec., but not quite so well thereafter, as 24 min. 10 sec. were taken from Wymondham to Thetford, and 9 min. 5 sec. thence to Brandon. Once again the difference in the work of a six-coupled engine, more particularly in starting and uphill, is very noticeable. No. 1516, with 31 axles, or 215 tons, actually ran from Trowse up to Wymondham in 12 min. 25 sec., and also the 7·2 miles from Thetford to Brandon in the very smart time of 8 min. exactly, start-to-stop; the running between Wymondham and Thetford, however, was not so brisk, as this length occupied 24 min. 25 sec. These runs illustrate the much increased smartness



Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY.

4.12 p.m. South express *ex*-Carlisle, near Penrith.
Four-cylinder converted superheater 4–6–0 engine *Prospero* leading, and 4–6–0 superheater engine *Lord Lytton*, train engine.

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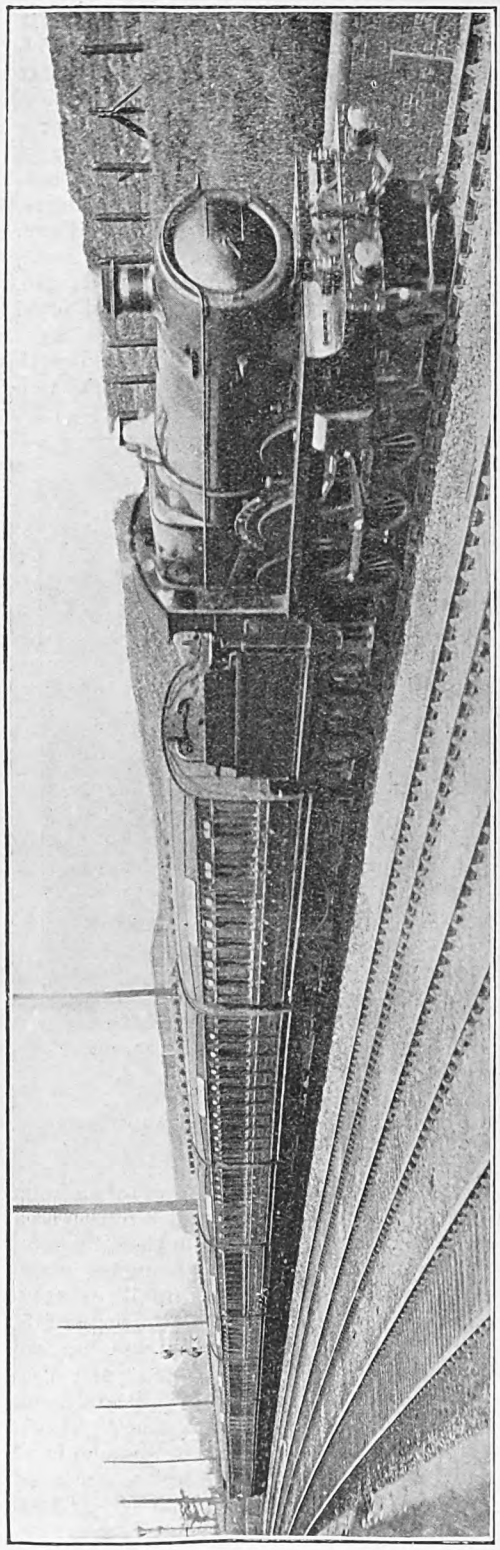

[F. E. Mackay.

GREAT WESTERN RAILWAY.

3.35 p.m. down South Wales express. 4–6–0 locomotive No. 2787 *Bride of Lammermoor.*

Photo]

of point-to-point Great Eastern Railway times, in the working of which 4–4–0 engines bear a large share. I had intended to follow on with some notes on runs on the Southend branch, but these must now wait until a future occasion.

From the Great Eastern to the South Eastern and Chatham Railway—two lines worked under very similar running conditions—is but a brief step, and I may as well take the present opportunity of mentioning some excellent runs on that line of which I have received details from correspondents recently. The first two of these were from Folkestone to London, by the 10.40 a.m. and 8.30 a.m. trains, allowed respectively 83 and 90 min. for the 68¾ miles' journey to Cannon Street. On the former No. 732, a Wainwright 4–4–0 with ordinary round-topped firebox, had a modest load of 215 tons. The start to Westenhanger, entirely at 1 in 263–266, was very sluggish, this 5⅞ miles taking 11 min. 40 sec., but after that matters improved, as the subsequent 8⅛ miles to Ashford occupied 8 min. 5 sec., the 10¾ miles thence to Headcorn 10 min. 40 sec., and the 10½ miles from Headcorn to Paddock Wood 10 min. 25 sec. Thus the 29⅜ miles from Westenhanger to Paddock Wood had been covered in 29 min. 10 sec. A bad signal check was experienced outside Tonbridge, so that the 5¼ miles from Paddock Wood to Tonbridge took 6 min. 10 sec.; but a good recovery followed, the 7½ miles from Tonbridge up to Sevenoaks—entirely at 1 in 122–144—taking 12½ min., and the 4 miles at 1 in 143 from Dunton Green to Knockholt 5 min. 5 sec. This made the total time 66 min. 10 sec. for the 53½ miles from Folkestone to Knockholt. Thence to Hither Green the 9⅜ falling miles were covered in 8 min. 40 sec., and the final 5⅞ miles into Cannon Street, inclusive of a severe check outside London Bridge, accounted for another 9½ min. The total time for the journey was therefore 84 min. 20 sec., or 82 min. net.

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On the second occasion No. 502, an engine of the same type, but of later and somewhat improved design, had a slightly lighter train of 205 tons, and made a run in strong contrast to the foregoing. Westenhanger was passed in 10½ min., and the 34⅝ miles thence to Tonbridge were actually covered in 33 min. 55 sec., of which length the 21¼ miles from Ashford to Paddock Wood occupied only 20 min. 5 sec. From the start, therefore, the passing times were: to Ashford, 14 miles, 18 min. 40 sec.; to Headcorn, 24¾ miles, 28 min. 50 sec.; to Paddock Wood, 35¼ miles, 38¾ min.; and to Tonbridge, 40½ miles, 44 min. 25 sec. This is one of the fastest starts on a South Eastern and Chatham west-bound train that I have ever seen recorded. After this, with time well in hand, there was obviously no further need for haste; thus the 13 miles from Tonbridge up to Knockholt took 21 min. 10 sec., and the 9⅜ miles thence to Hither Green 9 min. 25 sec. Delays spoiled the conclusion of the run, the arrival at Cannon Street being 88½ min. after leaving Folkestone, but not more than 83 min. net—a very praiseworthy effort.

From the same correspondent come some details of a run behind one of the large superheater 4–4–0 engines—No. 776—which calls for special comment. The train left Tonbridge 7 min. 20 sec. late, with a load of 195 tons, and practically the whole of the arrears were regained. A fine climb to Knockholt was made, the initial 7½ miles to Sevenoaks taking 13 min. 25 sec., and the subsequent 4 miles from Dunton Green to Knockholt 4 min. 35 sec.; the total time for the 13 miles from Tonbridge to Knockholt was 19 min. 40 sec. Some fast downhill work followed, the 11 miles from Knockholt to St. John's occupying 9 min. 55 sec. only, of which the 8⅛ miles from Chelsfield to Hither Green were reeled off in 7 min. exactly. Thus New Cross, 24⅝ miles, was passed in 30 min. 25 sec., and London Bridge, 27¾ miles, was reached in exactly 35 min., or in 7 min. under schedule time. This also was a very creditable run.

But the best of these South Eastern and Chatham runs comes from another friend, and relates to the up "Cliftonville" express, made up to the unusual weight of 275 tons, and, curiously enough, hauled by No. 275, the engine first experimentally fitted with the Schmidt superheater. A strong north-west wind and an occasional drizzle made the task of the engine no easy one in hauling this heavy load over the severe grades between Margate and Victoria in 91 min., as the distance is 74 miles. Birchington, 3¼ miles, was passed in 6 min. 13 sec., the minimum speed at Eddington being 44 miles per hour, after which followed two bad permanent way checks. So the 15¼ miles to Whitstable took 20 min. 55 sec., and the 22 miles toFaversham, where the usual slack was made, 28 min. 40 sec. On the short descent past Teynham a maximum speed of 65 miles per hour was reached, after which the lowest rate on the 7-miles' ascent at 1 in 220 past Sittingbourne was 50 miles per hour; finally, the short fall at 1 in 132 past Newington produced a further maximum of 62 miles per hour. Thus Sittingbourne, 29¼ miles, was passed in 37 min. 23 sec., and Chatham, 39¾ miles, in 48 min. 41 sec. The usual slack past Rochester Bridge followed, and the speed had not risen above 40 miles per hour beyond when the toilsome ascent of Sole Street bank commenced. A fine ascent of this grade was made, the 5 miles at 1 in 100 taking 8 min. 49 sec. and not reducing the speed below a sustained 31 miles per hour; the 7½ miles from Chatham to Sole Street in all consumed 12¾ min., making the total time 61 min. 26 sec. for the 47¼ miles from Margate. Fast running now ensued on the sharply undulating grades between Sole Street and Beckenham; the maxima at Farningham Road, St. Mary Cray and Shortlands were 71, 64 and 67 miles per hour, while the intervening minima at Swanley and before Bickley were 53 and 59 miles per hour respectively. So the 9 miles from Sole Street to Swanley took 9 min. 36 sec.; the 9 miles thence to Beckenham 8 min. 53 sec.; the 4¾ miles from Beckenham to Herne Hill 5 min. 29 sec.; and the last 4 miles into Victoria 6 min. 47 sec. The aggregate time from Margate to London was thus 92 min. 11 sec., but allowing for the early permanent way delays, the net time did not exceed 89¾ min. This net average of 49·5 miles per hour, considering the difficulties of the route, is certainly fit to rank with the best of modern British locomotive work.

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British Railway Officers in War Service [No. III.].

IN previous articles particulars have been given of the numbers of railway men who have taken their places with His Majesty's Forces, showing very substantial increases over figures published early in the year. Soon after we closed for press last month the Railway Executive Committee issued a complete statement giving up-to-date figures, and this may fittingly be included here :—

	Total No. of men employed at commencement of war.	Total No. of men who have enlisted to 31 Aug., 1915	Percentage of men enlisted to total No. employed.
Alexandra (N. & S. W.) Docks and Railway ..	1,588	275	17·3
Avonmouth Light Rly. ..	2	1	50·0
Barry	3,121	412	13·2
Brecon and Merthyr ..	625	67	10·72
Burry Port	179	9	5·0
Caledonian	23,766	2,794	11·8
Cambrian	1,912	216	11·3
Cardiff	2,419	443	18·3
Cheshire Lines Committee	5,117	600	12·7
Cleator & Workington ..	172	18	10·5
Cleobury Mortimer and Ditton Priors	25	5	20·0
Cockermouth Keswick & Penrith	151	15	10·6
Colne Valley	124	10	8·0
Easingwold	11	1	9·0
East London	84	19	22·62
East and West Yorks U.	55	6	10·9
Festiniog	90	10	11·1
Furness	2,712	231	8·55
Glasgow & South Western	9,804	1,379	13·05
Great Central	34,505	5,021	14·55
Great Eastern	33,676	4,889	14·5
Great Northern	34,458	4,479	13·0
Great North of Scotland..	2,575	292	11·34
Great Western	79,150	13,965	17·6
Highland	2,825	229	8·1
Hull and Barnsley ..	3,497	698	19·96
Isle of Wight	163	32	19·63
Isle of Wight Central ..	162	34	21·0
Kent and East Sussex ..	49	3	6·0
Knott End	33	3	9·0
King's Lynn	81	10	12·5
Lancashire and Yorkshire	37,812	6,191	16·37
Liverpool Overhead ..	417	50	12·0
London Brighton and S. C.	16,269	2,205	13·55
London & North Western	93,106	16,317	17·52
London & South Western	24,270	2,988	12·23
Lynton and Barnstaple ..	63	9	14·2
Manchester South Junction and Altrincham ..	13	1	7·69
Maryport and Carlisle ..	507	54	10·65
Mersey	429	75	17·5
Metropolitan	3,249	572	17·5
Metropolitan District ..	2,499	769	30·0
Midland	74,964	10,983	14·65
Do. (Tilbury section)	(Included in Midland figures).		
Midland & S. W. Junction	534	49	9·1
Mid-Suffolk	51	3	5·88
Neath and Brecon ..	284	33	11·6
North British	24,858	2,500	10·06
North Eastern	54,462	7,866	14·44
Midland and Gt. North. Jt.	2,423	306	12·63
Midland & N. E. Joint ..	(Included in parent companies' figures).		
North & South West Junc.	(Included in London & N. W. figures).		
North Staffordshire ..	5,699	627	11·0
North Sunderland ..	8	—	—
P. D. and S. W. Junc. ..	36	4	11·1
Port Talbot	1,146	162	14·14
Rhondda & Swansea Bay	266	23	8·64
Rhymney	1,722	249	14·46
Shropshire and M. L. ..	44	2	4·54
Somerset and Dorset ..	1,435	158	11·01
*South Eastern & Chat. ..	23,092	2,689	11·64
Southwold	32	1	3·12
South Yorkshire Junction	76	16	21·00
Strat.-on-Avon & Mid. Jt.	245	14	5·7
Taff Vale	4,883	775	15·87
West London Extension..	153	15	9·8
Weston Clevedon & Portishead	31	3	9·67
Wirral	289	30	10·00
Railway Clearing House..	3,090	713	23·07
Grand total	621,588	92,658	14·90

* The figure of 2,689 represents men who had enlisted to 31st July, 1915.

Several other items of interest pertinent to our subject may now be referred to. The appointment of the Duke of Devonshire a Civil Lord of the Admiralty rendered it desirable that he should resign the Chairmanship of the Furness Railway Company. In consequence of this retirement the Right Hon. Lord Muncaster, Deputy Chairman, was appointed Chairman, Mr. F. J. Ramsden becoming Deputy Chairman.

In the case of this railway the following items may be referred to. Mr. A. H. Douglas, engineer's pupil, is a Second Lieutenant in the Signalling Corps of the Royal Engineers,

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whil M. G. Walker, also an engineer's pupil, was a Lieutenant in the 4th King's Own (Royal Lancaster) Regiment, Territorial Force. He went to the front in France and was reported wounded and missing on the 14th June, 1915. From the Locomotive Department Mr. W. H. S. Aplin holds a commission as Flight Lieutenant, R.N.A.S. He has been in the Furness Company's service 1½ years, having been chiefly employed in the drawing office and inspecting materials. Before joining the Furness Railway service he served his apprenticeship with Messrs. Plenty & Son, Limited, Eagle Iron Works, Newbury, where he obtained considerable experience in internal combustion engines. Mr. J. Paris, who has been working in the Furness Railway Erecting Shop for over three years, has obtained a commission as Second Lieutenant in the 17th Durham Light Infantry.

H. W. DRUMMOND, ESQ.
Chairman, London and South-Western Railway.

Among the various Chairmen, Deputy-Chairmen and Directors of leading railway companies who are rendering active assistance in war service, one of the most interesting personalities is the Chairman of the London and South Western Railway Company, Col. H. W. Drummond. He formerly served in the Rifle Brigade, and like many other gentlemen with previous military experience, has come forward to assist his country in her time of need. Col. Drummond for some time commanded the Royal North Devon Hussars (Yeomanry), but retired a few years back. Shortly after the outbreak of war he was asked to raise a second (reserve) regiment, which he did in a very short time. After training this regiment for some months Col. Drummond was promoted to take charge of the 2/2nd South Western Mounted Brigade, which includes the Royal North Devon Hussars, now commanded by Lord Clinton, a former officer of that regiment, and also a Director of the London and South Western Railway Company.

In addition to members of the London and South Western Railway Company's staff holding commissions mentioned last month, we are advised that Mr. K. M. Douglas, from the Estate Department, is now a Lieutenant, Seaforth Highlanders. We may also mention that Mr. Henry Holmes, M.V.O., the well known Superintendent of the Line, holds the rank of Major in the Engineer and Railway Staff Corps.

Owing to the transfer of Sir H. F. Donaldson, Chief Superintendent of Ordnance Factories, Woolwich Arsenal, Mr. Vincent Litchfield Raven, Chief Mechanical Engineer, North Eastern Railway, who has already done good service in the Munitions Department, has been appointed to take charge as Superintendent at Woolwich Arsenal, thus adding another to the already large and

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increasing list of important Government appointments filled by a railway official.

Mr. Raven was appointed Chief Mechanical Engineer, North Eastern Railway, in June, 1910, as successor to Mr. Wilson Worsdell. He was born at Great Fransham, Norfolk, where his father was rector, and was educated at Aldenham School, Herts. On leaving there he went to the North Eastern Railway as a pupil under the late Mr. Edward Fletcher. After completing his pupilage he continued in the service of the railway, serving successively under four chief mechanical engineers, and passing through various positions until his appointment as assistant mechanical engineer, which position he held for about fifteen years.

Succeeding one of the best-known railway engineers of his period—Mr. Wilson Worsdell—Mr. Raven had no easy task to develop the work of his department. Yet he has placed his mark upon locomotive engineering to a degree that only a few other engineers have equalled, and in doing so has developed a practice which is characteristic.

Mr. William Goodley, Superintendent of the March Division of the St. John Ambulance Brigade and First Officer of the March Division of the Great Eastern Railway Ambulance Corps, who, with other well-known enthusiastic workers in ambulance matters in the Fen district, volunteered for service with the Royal Army Medical Corps in December last, has been promoted from Sergeant-Major to Lieutenant and Quartermaster.

A commission has been granted to Private E. B. Rattray, the eldest son of Mr. J. B. Rattray, of the Cheshire Lines Committee. He was appointed to a second lieutenancy in the 4th South Lancashire Regiment. He was formerly lance-corporal in the 6th Rifles, King's Liverpool Regiment.

Captain H. S. K. Woodhouse, of Crewe, has been gazetted to the rank of Major in the Liverpool Regiment. Major Woodhouse was a Territorial captain when war broke out, and he has been in the fighting line several months. He is a well-known official in the engineering department of the London and North Western Railway works at Crewe.

The *Gazette* recently contained the following notice: "Assistant Director of Inland Water Transport (graded for purposes of pay as an Assistant Quartermaster-General): Temporary Major G. J. Baugh, R.E., from a Deputy Assistant Director at War Office, and to be Temporary Lieut.-Col. while so employed (30th August)." Before he rejoined the service Col. Baugh was Marine Superintendent, Lancashire and Yorkshire and London and North Western Joint Railway, Fleetwood, as described last month, when we had the pleasure of reproducing his portrait.

The Brecon and Merthyr Railway have three of their directors serving with the Colours, namely Lord Tredegar, Viscount Duncannon, M.P., and Lieut.-Colonel David Davies, M.P.; while a fourth director, Colonel Stephenson Clarke, C.B., D.S.O., who served throughout the South African campaign, may any day be called upon to rejoin the Colours. We believe this record is unique for a railway company, as the Board only number eight altogether.

We regret to learn that amongst those who have died of wounds received in action is Capt. H. I. Wykes, of the 6th Wilts Regiment, Chief Assistant in the Surveyor's Department of the Great Northern Railway. Capt. Wykes was articled to Mr. Daniel Watney, and in 1906 won the Galsworthy Prize of the Surveyor's Institution. In 1908 he joined the staff of the surveyor of the Great Northern Railway Company, and when Mr. Parnwell left the office to take up the position of land agent to the Great Eastern Company, Mr. Wykes became chief assistant. The deceased was buried with full military honours at Rouen.

Lieut. L. G. Dickinson, of the 6th Sherwood Foresters (T.F.), and before the outbreak of hostilities attached to the clerical staff of the mineral manager's department, Midland Railway, Derby, was killed in action in France on September 30th. For some years he was a member of the Territorial Force at Matlock, and when war broke out was Colour-Sergeant. After going to France he was appointed Quartermaster-Sergeant, and was finally promoted to Second Lieutenant. He was thirty-seven years of age, and was the only son of Mr. F. G. Dickinson, formerly on the staff of the Midland Railway goods department, Sheffield, afterwards goods agent at Rowsley, and for some time prior to his retirement several years ago an inspector in the Manchester district.

It is only the larger railways which can spare many of their chief officers, and some of them owe their appointments on active service largely to the fact that they already held commissions in Territorial or other forces already constituted and which were,

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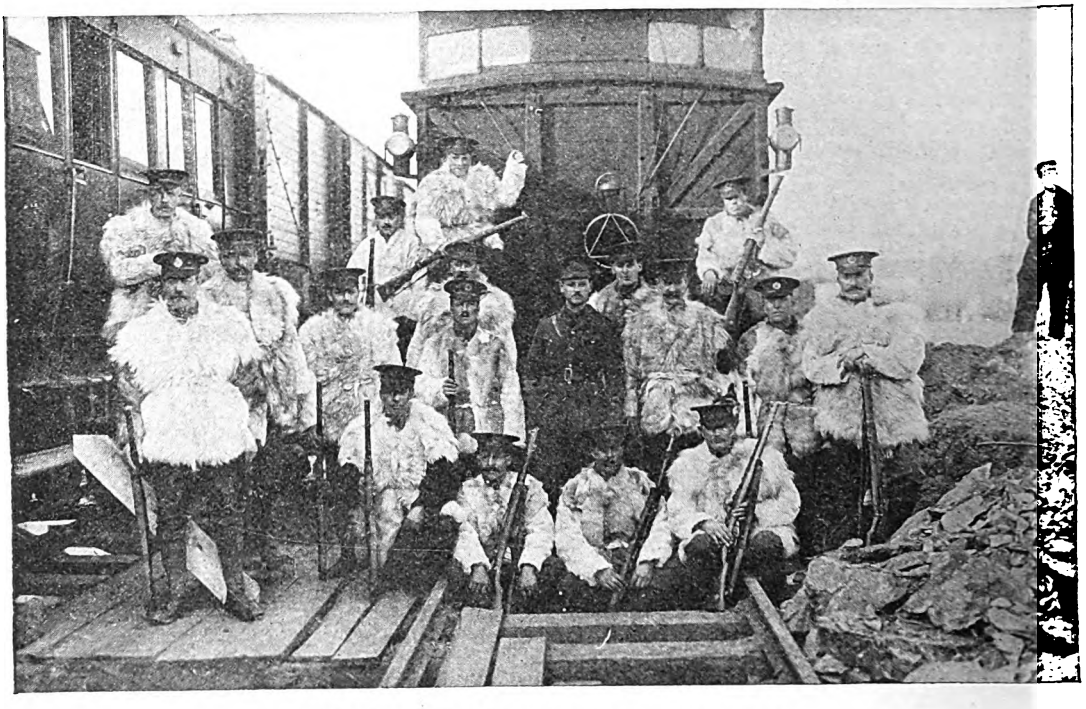
of course, called up on the outbreak of war. The following is a reply characteristic of several we have received in answer to our enquiries in connection with this article: "Ever since the outbreak of the war an enormous quantity of naval and military stores, troops, naval mails, baggage, etc., etc., has been thrown upon this Company for conveyance to and from naval and military centres, with the result that the line has been greatly congested and the whole of the Company's staff has had to work at high pressure to deal with the unprecedented situation. In the circumstances, it has not been possible for the Company to spare any Chief Officers for active service with the naval or military forces."

In conclusion, it is well to remember the services which have been, and are being, rendered by railwaymen at home. A great deal has been made, and with full justification, of the generous response which our railwaymen have given to the country's call for men to serve with His Majesty's forces on sea and land, but it is only right that some recognition should be made of what those at home have been and are doing. In most of the great railway shops a considerable proportion of the men are doing munition work or otherwise engaged in meeting requirements, while the remainder have all they can do to keep engines and rolling stock in working condition, and otherwise meet the requirements of traffic and maintenance. On the traffic side the majority of the staff are working valiantly to compensate for shortages of men and to meet the hundred and one special requirements associated with these times. With the railwaymen the badge of



A GROUP OF GREAT CENTRAL RAILWAYMEN IN FRANCE.

Sapper Ross, A. (Guide Bridge).
" Hardy, A. G. (Marylebone).
Lance-Corpl. Smith, R. F. (Sheffield).
Sapper Stacey, E. (Staveley Town).
" Brett, J. (Immingham).
" Lansley, F. (Barnetby).
Lieutenant S. E. Fay.
Sapper Sellwood, A. H. (Sheffield).
" Towndrow, H. (Spink Hill).
Sapper Ryder, W. F. (Wath Hump).
" Bradley, F. (Rotherham).
Sergeant Coldwell (Marylebone).
2nd Corpl. Thorpe, J. H. (Langwith Junction).
Corpl. Noble, T. (Sheffield).
Sapper Spencer, T. (Grassmoor).
" Smith, T. (Sheffield).
" Swabey, H, (Market Rasen).
" Flippance, O. G. (London).

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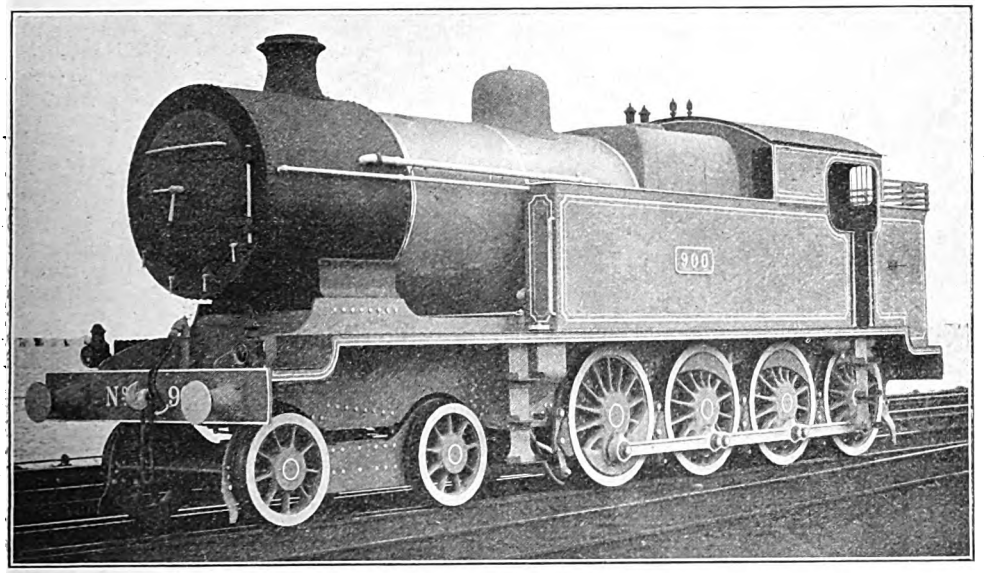
national service is no mere decoration; it is an indication of patriotic service, and while this is fully realised by chief officers, as shown by many of their circular letters and notices to the staff, as well as in more or less public utterances on various occasions, it is well that this aspect should be emphasised more than it has been in general circles. With notable percentages of the staff on active service, our railways have an exceptional record; but the remainder at home are actively compensating for their colleagues with the fighting forces, and in doing so are performing duties equally valuable, and in many cases working far harder than they have ever done before, in view of the enormous volume of traffic being conducted, largely of a character which is peculiar to the conditions now existing.

A REMARKABLE GREAT SOUTHERN AND WESTERN RAILWAY LOCOMOTIVE.



THE engine illustrated was designed by Mr. E. A. Watson, M.I.Mech.E., Locomotive, Carriage and Wagon Superintendent, Great Southern and Western Railway, and has just been completed at the Company's works at Inchicore, Dublin. It is the only one of its kind in Ireland—indeed, the only other 4–8–0 tank engines in the United Kingdom are those on the North Eastern Railway—and has been specially designed for heavy shunting work in the goods yard at the Kingsbridge terminus, where the gradients are as severe as 1 in 80 and 90, together with a number of very sharp curves, the engine being required to move as many as 50 and 60 ten-ton wagons at one pull.

The engine has been built with the idea of absolute simplicity throughout. It is fitted with inside cylinders, driving the first pair of coupled wheels and Stephenson's link motion is employed for actuating the balanced slide valves which work above the cylinders. The boiler is equipped with a Belpaire firebox, extended smokebox, and works at a pressure of 175 lbs. per square inch. It is fitted with Ross patent muffled pop safety valves.

Cylinders, diameter	19¼ in.
Pistons, stroke	26 in.
Wheels, bogie, diameter ..	3 ft.
Wheels, coupled, diameter ..	4 ft. 6½ in.
Wheelbase, total	29 ft. 1¼ in.
Wheelbase, rigid	15 ft. 3 in.
Boiler, height of centre line over rail	8 ft. 10¼ in.
Boiler, length of barrel ..	11 ft. 3 in.
Boiler, diameter of barrel, minimum inside	4 ft. 10½ in.
Firebox casing, length outside ..	7 ft.
Heating surface, firebox ..	138·5 sq. ft.
Heating surface, tubes	1,426·75 sq. ft.
Heating surface, total	1,565·25 sq. ft.
Grate area	24·8 sq. ft.
Weight in working order, coupled wheels	62 tons
Weight in working order, total	80 tons
Length, total over buffers ..	37 ft. 10¾ in.

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A Notable Locomotive Rebuild on the Great Northern Railway.

THAT the war has not stopped all special work on our railways, in the way of more or less interesting and notable locomotive reconstructions and rebuilds, some of them of an experimental or developmental character, is shown by the series of engines on various lines to which these remarks apply and to which reference has been made in these pages, such as the 4-cylinder adaptation of the London and North Western Railway 4-6-0 engine *Prospero*, in accordance with the Dendy-Marshall system, the equipment of Great Eastern Railway locomotives by Mr. Hill with Weir feed water heaters and pumps, and Mr. R. W. Urie's various rebuilds on the London and South Western Railway, to the latest of which reference is made elsewhere in this issue.

To this interesting series is now added a somewhat remarkable reconstruction of 4-4-2 engine No. 279, as illustrated in our frontispiece, by the courtesy of Mr. H. N. Gresley, Locomotive Engineer, Great Northern Railway.

Engine No. 279, built in 1904, was one of Mr. Ivatt's well-known 2-cylinder "Atlantics," with wide firebox boiler. It has now been rebuilt with four high-pressure cylinders 15 in. in diameter with 26 in. stroke. All four cylinders drive on to the trailing coupled wheels, the inside cylinders being inclined and placed behind the smokebox immediately over the trailing axle of the bogie. The valves for the outside cylinders are actuated by Walschaert valve gear, the valves for the inside cylinders being actuated by a rocking shaft which is coupled to the tail rods of the valve spindles by links. The engine is fitted with standard wide firebox boiler with twenty-four element Robinson superheater. The crank axle used on the driving wheels is a built-up balanced crank patented by Mr. Ivatt about nine years ago.

Leading dimensions, in the original condition and as converted, are as follows:—

	Original condition.	As converted.
Cylinders ..	18¾ in. × 24 in. (2)	15 in. × 26 in. (4)
Coupled wheels	6 ft. 8 in.	6 ft. 8 in.
Bogie ,,	3 ft. 2 in.	3 ft. 2 in.
Trailing ,,	3 ft. 8 in.	3 ft. 8 in.
Coupled wheelbase	6 ft. 10 in.	6 ft. 10 in.
Total wheelbase	26 ft. 4 in.	26 ft. 4 in.
Steam pressure	175 lb.	170 lb.
Heating surface—		
Tubes ..	—	1,882 sq. ft.
Firebox ..	—	138 sq. ft.
Superheater ..	—	427 sq. ft.
Total ..	2,500 sq. ft.	2,447 sq. ft.
Grate area ..	31 sq. ft.	31 sq. ft.
Weight in working order (engine)	65½ tons	73 tons 10 cwt.

Crimple Tunnel.

OUR illustration in the last issue entitled "A Picturesque View on the Great Northern Railway" was, as several readers remind us, somewhat incorrectly headed, as in point of fact the tunnel shown—Crimple Tunnel—is over 36 miles distant from the nearest point of the Great Northern system. Crimple Tunnel, or "Prospect" Tunnel, as is its official designation, is situated on the North Eastern Railway, 2¼ miles south of Harrogate, on the line from Church Fenton and Wetherby. A quarter of a mile north of the tunnel Crimple Junction is reached, where this line is joined by that from Leeds, *viâ* Bramhope Tunnel and Arthington. Immediately beyond is the Crimple Viaduct, crossing the older line from Arthington to Starbeck, which was the station for Harrogate until the present line was constructed, passing across the famous "Stray," and through the centre of the town. This part of Yorkshire is very hilly, and Prospect Tunnel is in the centre of a long and difficult climb from below Spofforth almost to Harrogate, 5 miles mostly at 1 in 85–95. The descent out of Harrogate is even worse, being for 2 miles down to Bilton Junction at 1 in 66. The Great Northern Railway works its own trains into Harrogate, the route from Doncaster being for 4½ miles over the Great Northern Railway to Askern Junction (just beyond Shaftholme Junction), then for 10¼ miles over the Lancashire and Yorkshire Railway to Knottingley, and for the remaining 28 miles over the North Eastern Railway *viâ* Ferrybridge, Milford Junction, Church Fenton, Tadcaster and Wetherby into Harrogate.

Reconstruction of Temple Station, Metropolitan District Railway.

As one of the best-known stations on the Metropolitan District Railway, "The Temple," is used by many thousands of passengers daily, and has always attracted considerable attention owing to its peculiar constructional

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characteristics—a low one-storied range of buildings between the Embankment proper and the Norfolk Street Approach, and adjacent to the Temple Gardens. This range of buildings is in the occupancy of Messrs. Partington & Co., the station booking hall and premises utilising only a small portion, and is itself somewhat peculiar owing to the fact that for part of its length there is a central opening, so that the railway tracks below are open to the sky.

In conjunction with the policy of modernising and developing station premises—Charing Cross constitutes the most conspicuous example of notable work in this way, though several other stations are now almost as interesting—this range of buildings is now in course of reconstruction Mr. H. W. Ford, architect to the Underground Electric Railway Companies, is responsible for the design, as architect for Messrs. Partington's, who are carrying out the reconstruction with the approval of the Metropolitan District Railway. There will be two entrances to the booking hall, one in the old position near the steps from the Norfolk Street Approach, the other directly from the Embankment footway. In the corner will be the booking office, and from the circulating area access will be had to the stairways leading to the platforms through the central gates in the now usual open ironwork partition. A separate exit will be provided, largely utilising the old stairway, from the up platform to the Norfolk Street Approach. Remaining space at the end will provide for two shops.

Station Architecture and the Royal Academy.

THE rest of the buildings, still only one storey in height, are arranged to suit the requirements of Messrs. Partington's business, with a large restaurant adjacent to the booking hall, but with access from the Embankment footway. Instead of the fairly long rectangular well over the railway tracks, there will be four small wells or "areas," the buildings being grouped round these as shown. The roof forms a kind of promenade, and might be utilised as such were there need therefor, and is fitted with railings round the outer edges and the ventilation wells or areas. The length of the range of buildings is 280 ft., the width being 80 ft. tapering to 48 ft. The architecture is of the Tuscan order, and the building of Portland stone, containing only one floor, 17 ft. 10 in. in height, a necessity in view of the large buildings behind. The end and Embankment elevations are being carried out in Portland stone. The back of the premises. in Norfolk Street Approach, will be plain, but the two existing staircases will remain. The shops will have windows facing outwards, instead of being contained wholly within the station premises. The restaurant will be about 60 ft. by 66 ft. The importance of the architectural scheme was emphasised by the exhibition of the design in this year's Royal Academy. The work is now reaching the concluding stages.

Chalk Farm Alterations: London and North Western Railway.

LAST month, in the course of the article dealing with "The Engineer's Department of a Great Railway," reference was made to the remarkable character of the alterations now in progress at Chalk Farm, London and North Western Railway, for which Mr. Trench and his assistants are responsible. As the matter is of general interest a brief explanation of these works, with a sketch plan (page 400) showing the lay-out intended, will be in order.

These alterations are designed to enable electric and "slow steam" traffic to be worked into and out of Euston independently of the main line traffic, and in connection with the Broad Street route the electric and slow routes to be separated—with inter-connections in all required directions—so that no train need foul any line of opposite direction or any route of same direction with which it is not required to connect—and the electric lines continued through new "tube" tunnels alongside the existing Primrose Hill tunnels.

At Chalk Farm the London and North Western station (now demolished) had five lines, an engine road, the down main running behind the down platform, the down platform line, and up main and up slow lines with an island platform between. On the other side the North London station consists of two islands, with up and down through lines outside and a down road in the centre, signalled for through traffic, but usually employed for terminating Broad Street trains. Between the two sections are the shunting necks and the train-waiting lines associated with Camden goods depôt, and beyond the North London up line is a goods line. Further along there are surface cross-overs between the fast lines and the slow line tunnel under Primrose Hill, to which tunnel also the goods and North London tracks give access.

The Changes Involved.

IN the station the North London portion will remain substantially as at present, but the London and North Western station has been entirely removed, the site receiving an outer down main, down and up local lines (to be used also by electric trains) in the centre, and the up main, with goods and engine lines as already existing. Beyond the station the down main will be the only line unaltered. From the site of the London and North Western Railway station the down and up slow lines will descend between retaining walls to pass under the up main line, which will be raised somewhat to co-operate. At the foot of the grade the down local line first divides, one section, for down slow traffic, rising to the existing slow line tunnel, while the other keeps at the low level and passes by cut-and-cover work under all lines to the new down "tube" on the east side by which electric trains will pass under Primrose Hill.

The up slow line descends from the existing tunnel and before it comes alongside the down slow line is joined by the up electric line from

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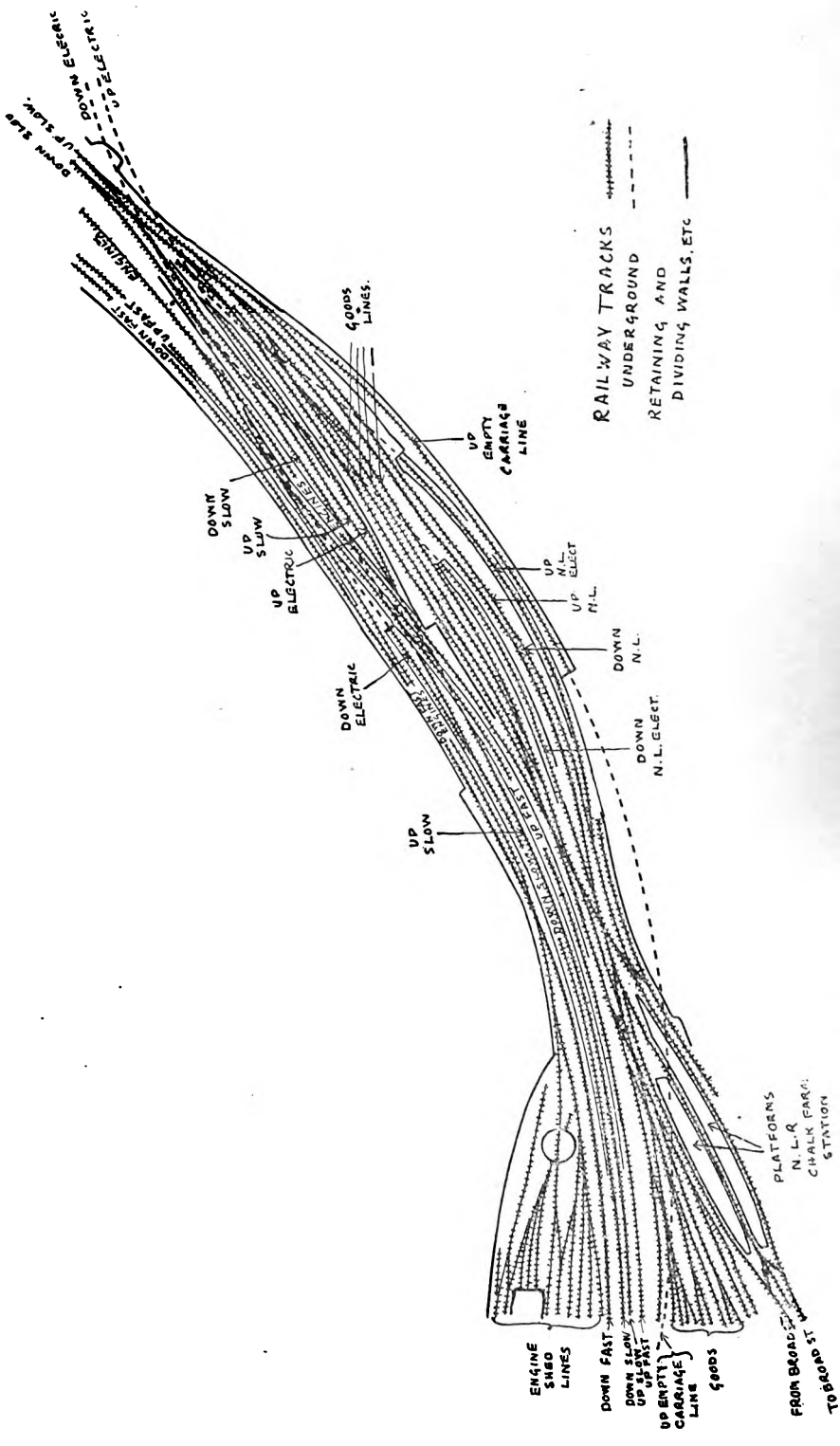

SKETCH PLAN SHOWING NEW LINES AND CONNECTIONS BETWEEN CHALK FARM STATION AND THE PRIMROSE HILL TUNNELS, LONDON AND NORTH WESTERN RAILWAY.

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the new tube for up electric traffic. The down electric line passes under the up slow before it connects with the up electric lines, so that there is no crossing of tracks.

On the North London side the down line will continue nearly as at present to join the slow line tunnel, but just beyond the station will put off a new electric line falling and continuing in cut-and-cover to join the down electric line from Euston near the mouth of the tube, while the up electric line will diverge near the mouth of the tube and rise thence to the station to join the up North London line.

In addition, from the slow line tunnel an up empty carriage line diverges and descends steeply to a new line extending in a low level tube (already completed and in use) from the extreme east of the area under notice, and passing diagonally under the running lines and the goods yard rises on the down side near the Regent's Canal Bridge to connect with the engine lines into Euston. The purpose of this line is to convey the numerous empty carriage trains from Willesden from the up slow line right across to the down side, and so by means of lines already existing to the departure side of Euston station. There are also several engine lines and goods connections to complicate the work.

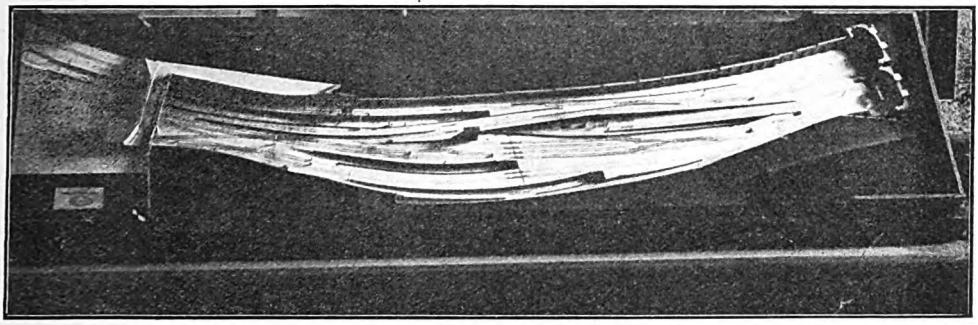
New Connections to be Available.

It will be seen that this complicated work—perhaps more involved than any other undertaking of a similar character—will give access without conflicting with other lines as follows: (1) Down main to down main; (2) down slow to down slow; (3) down slow to down electric; (4) down North London to down slow; (5) down North London to down electric; (6) up main to up main; (7) up slow to up slow; (8) up electric to up slow; (9) up slow to up North London; (10) up electric to up North London; and (11) up slow to special up empty carriage line.

Under Primrose Hill the electric lines will pass in separate "tubes" (now under construction) at a lower level than existing lines, rising to their level at Loudoun Road. These tubes will be 16 ft. 4 in. diameter, and constructed by the usual shield method, except that the rings will be 2 ft. 6 in. long instead of 20 in. Along each will be on one side a concrete platform extending the whole length, thus providing a passage way for detraining passengers in the unlikely event of a breakdown. The space enclosed by the platform will be convenient for cables and pipes, instead of suspending them from brackets on the tube walls as usual. The empty carriage line is also carried in a tube of the same diameter, but the platform is not in this case called for.

In conjunction with the alterations, the bridge carrying Regent's Park Road across the railway area has been replaced, except for one span, by a long-span girder bridge.

A photograph is reproduced showing a model of the new lay-out. This model was made for demonstration purposes when the scheme was first considered. It is a fine piece of work, but the photograph was necessarily a difficult one to take effectively, though that reproduced is of interest in conjunction with the sketch plan and the foregoing description.



PHOTOGRAPH OF MODEL OF NEW LINES AT CHALK FARM, LONDON AND NORTH WESTERN RAILWAY.

Goods Traffic under War Conditions.

Under this title, Mr. Frederick W. West, London District Goods Superintendent, South Eastern and Chatham Railway, described recently in the columns of the *Daily Telegraph* the general effect of present conditions upon methods of dealing with goods traffic. He points out that even in normal times the railways were very nearly taxed to their utmost resources to cope with the merchandise of the country, and it is therefore obvious that when they were called upon to deal with an enormous addition of traffic in the shape of munitions, and the many commodities required in the making of them, it was necessary that some new machinery should be set up to deal with the new situation. Simultaneously, moreover, the "call of the war" took away 13 per cent. of the trained and experienced workers of the railways, and an even greater percentage of inexperienced men, who could not be replaced owing to the general absorption of the previously "unemployed." The effect has been that the railways have had to contend with a largely-increased traffic, consisting largely of war material, with a very much diminished staff, which has compelled them to adopt certain means of regulating the traffic. The main object has been, after adequately providing for

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all commodities pertinent to the prosecution of the war, to give preference to what is known as civilian traffic, in the order of its importance, and this has caused considerable anxiety to the responsible officers of the railways for the reason that every trader naturally thinks his particular traffic is highly important.

The need for a Control System.

RAILWAYS are common carriers, and in normal times receive at their stations any traffics tendered to them within the limits of their responsibility, and undertake to convey them within a reasonable time. The only restriction in the past has been that the merchandise should be tendered between, say, 6 a.m. and 6 p.m. During the early days of the war, however, it became apparent that with the reduced facilities for dealing with the traffic it was impossible to continue acceptance of goods in this way, and the stations were closed earlier in the day, but this did not reduce the quantity of goods tendered for conveyance, as the traders simply arranged to send in the same number of goods earlier, and the effect was that in many cases the earliest carmen to arrive succeeded in getting unimportant goods despatched to the exclusion of important ones, which was not satisfactory from the point of view of public expediency. This experience suggested that it was necessary to arrange a system of control, which would automatically give preference to the most urgent commodities over those which could take second or third place, and the results from the institution of that system, so far as it has gone, have been satisfactory.

The first traffic calling for treatment was return empty packages, consisting of drapery boxes and similar containers for general goods. These have always been a source of trouble to the railways, as they are as voluminous as the goods themselves, and occupy as much space in wagons and at the stations, while at the same time they are important to traders, because they require them for enclosing further goods. When regarded, however, from the point of view of the survival of the fittest, it was felt that they should not be allowed to hinder the conveyance of the really necessary goods by being forwarded indiscriminately as they had been, and on the South Eastern and Chatham Railway they were put under control.

The System in Operation.

BRIEFLY, the control system described by Mr. West means that persons having empty packages to forward must advise the station agent, and particulars are forwarded to the control office in London. The controller there, from the information he receives, decides when they can be accepted without hindrance to other traffics, and orders their acceptance accordingly. By this arrangement accumulation of empty packages at the various senders' premises is avoided, and the consignees are served with empties evenly as they require them; at the same time, there is no accumulation on the railways. Rough and heavy traffics, such as sand, bricks, cement, and similar commodities, are controlled in the same way, and although this subjects the traders to a little inconvenience, the system has been devised in the public interest, and has been found to be satisfactory.

On the South Eastern and Chatham Railway the hop traffic of Kent is a very important one, as it amounts to about 13,000 tons in the season, extending over about two months. In former years the hops have been carted into the country stations by the planters indiscriminately as they could get them dried and packed, and it was an enormous task to deal with the quantity in the time allowed, even with the maximum facilities by way of staff and cartage strength; but this year, with greatly reduced facilities, it was foreseen that it would be impracticable to handle the traffic by the old-time methods, and by arrangement with the hop factors in London and the planters in the country a system of control has been arranged whereby the quantities forwarded day by day are regulated through the control office in London to the satisfaction of all concerned. It will probably be necessary in the near future to regulate miscellaneous goods traffic in like manner for the period of the war, and although such restrictions will probably be removed when normal times are resumed, there seems little doubt that the lessons learnt by present experiences will be fruitful in the future.

Semi-Automatic Lifts: Underground Electric Railways.

REFERENCE has already been made to the fact that at several stations on the London Electric Railway—Piccadilly Circus, Great Central and Euston were first equipped—some of the lifts had been fitted with semi-automatic gear whereby it was no longer necessary for the liftman to accompany the lift in his charge on every journey. These equipments affected ten lifts, two at Piccadilly Circus in operation (these formed the subject of experimental equipments leading up to the design adopted), two others at the same station now being equipped, three at Euston, and three at Great Central station.

Experience has shown that it is practicable to adopt a different pattern of control or switchboard board, and Mr. W. A. Agnew, Mechanical Engineer, and Mr. Graff Baker, in charge of the lift section, have developed an improved system. This will apply, as at present arranged, to forty-one lifts at various stations, including eight on the City and South London Railway, where some of the hydraulic lifts are being taken out and replaced by electric lifts transferred from London Electric stations, either spare or rendered unnecessary in view of escalator installations.

The system adopted is electrical, devised by Mr. W. A. Agnew, Mechanical Engineer. Broadly

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speaking, no great changes are involved, and the scheme is based upon concentrating upon a relay exterior to the lift electrical connections which duplicate the control mechanism hitherto placed in the lift itself. In fact, lifts equipped can be, and are when more convenient, operated in the usual way by a lift attendant travelling with passengers. The earlier control boards have six plungers for normal use, one each for opening and for closing the entrance and exit gates, and two others, one of which is labelled "up" and the other "down," for starting the lift. Only one of these latter plungers manifestly applies, and, therefore, the other is arranged so that it does not project, and is normally sealed, though it is available in case of an emergency requiring a lift at the bottom landing to be started by means of the control board at the top. There are also two other plungers, coloured red. One of these is for stopping the lift as an emergency provision, while the other resets after use. In addition, there is a plunger marked "Indicator," the purpose of which is to cancel the illuminated sign directing attention to the particular lift concerned when another lift is intended to ascend or descend first. At the side of the casing an "Interlock" key has to be inserted, and unless this has been operated and is left in place the whole apparatus is inoperative. Each lift attendant is required to have one of these keys, the object of which is to ensure that unless it is being looked after the control board is placed out of action.

New Type of Equipment.

THE new equipment involves a circular switch cabinet, with four pull-over lever switches of usual type, applying respectively to "Entrance," "Exit," "Start," and "Stop." These cover all normal requirements, while further appliances included in the equipment of the lifts meet other conditions. A special relay is now included, so that any untoward condition involves the stoppage of the lift. To meet the possible over-running of the lift, it is arranged that in each up or down journey two contacts require to be completed, one just beyond the start, and one just before the stopping position is reached, so that the failure of any circuit has time to act through this special relay upon the motor control. To provide for the condition where the semi-automatic control is to be placed out of action, and a lift either left unattended or operated by a travelling liftman, the dome-shaped outer cover is adapted to be turned through an angle of 45 deg., limited by the movement of a pin through a slot of appropriate length. Such a movement obviously requires all four switches to be returned to normal, as otherwise they engage in their corresponding notches, and the cover cannot be moved. Normally, the cover is held by a pin carried by a flat spring behind the inner cover, and to release this a key or other appliance is passed through a central opening so as to press back the spring, and thereby release the holding pin. Re-engagement occurs automatically when the outer cover is returned to its former position. An indicator is to be applied advising the lift attendant on the lower landing as to which lift is next to descend. After the forty-one lifts to be fitted with this equipment have been dealt with, some of the lifts on the Central London Railway will be taken in hand, but these will require a modified type of installation owing to the different style of lift machinery involved.

Slower Expresses.

SUGGESTIONS have been made that express train should be slowed somewhat in order to meet the exigencies of the period, but although a good deal has been made in the newspapers of announcements of increased running times given to certain London and North Western Railway expresses, it is clear from analysis of these particular alterations that these decelerations are the result of "force majeure" rather than retrograde tendencies. A large number of the principal services now involve heavy train loads regularly, and excessive loading is not spasmodic as it often is in normal times, besides which station work is usually more complicated and frequently essentially different in character. With the influence of traffic complications throughout the system, the result is that very fast times cannot be maintained with any degree of certainty, and the alterations now announced virtually consist in making reasonable allowances for these factors and advertising times which are more likely to be adhered to than those announced. The semi-official explanation of the alterations made on the London and North Western Railway well expresses the position: "Lateness of arrival has become so regular as to make the existing time table positively misleading, and it is hoped that the new time table will be a more accurate index to the actual running times of the trains." There is another factor, that there is so great a demand for locomotive power that relatively small engines often have to work the heaviest trains, the larger ones being required on other duties, and although this may not apply as much on the London and North Western Railway as it does on some other lines, it certainly requires consideration, coupled with the fact that with decreased staffs and the necessity for keeping engines more continuously in service, it is extremely undesirable to press them to maintain hard schedules with big loads.

London and North Western Alterations.

WHAT has been done on the London and North Western Railway is to start the principal trains 5 min. earlier, reaching Crewe either at the old times or a few minutes later, a further 3-10 min. being added north of Crewe. The former only are strictly additions to high-average running times, and the latter appear to be rather in the nature of allowances for station duties with depleted staffs or with increased work to be done. Thus the 10.30 a.m., 12.10 p.m., 2.40 p.m., 6 p.m., and 6.10 p.m. expresses each leave 5 min. earlier, and arrive 5 or 7 min. later at destination, the former allowance being utilised to Crewe and

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NEW REFRESHMENT ROOM AT NUNEATON, LONDON AND NORTH WESTERN RAILWAY.

the latter beyond. There are also several other trains, such as the 12.15 p.m. and 5.30 p.m., started similarly earlier, but maintaining old times beyond, and certain other trains, such as the 2.45 p.m., are also affected in this way. The most drastic change is found in the "midnight" expresses from Euston. The 11.45 p.m. Edinburgh, and North express leaves at 11.15 p.m., but is only 20 min. earlier at Warrington and Carlisle, the remaining time to realise the old arrivals being utilised north of Carlisle. The midnight Glasgow train leaves at 11.30 p.m., but utilises an additional 11 min. to Crewe, while the arrival at Carlisle is 10 min. earlier than heretofore, which increased allowance is utilised on the Caledonian section. Anyone who knows how these trains load up will readily appreciate the importance of these allowances from the traffic working point of view.

Improvements at Nuneaton: London and North Western Railway.

On September 24th the London and North Western Railway opened at Nuneaton a new dining room, situated behind the old refreshment rooms, which are now being demolished. The dining room, which is directly to the left of the booking hall, is distinct from the refreshment rooms, and will be used exclusively for luncheons and afternoon teas. These will be catered for on the same style as at all hotels and dining rooms in the southern district of the Company, reaching from Euston to Stafford.

To celebrate the opening of the dining room, Mr. Cecil F. Grasemann, assistant to the General Manager, London and North Western Railway, who has now charge of the publicity department, gave a complimentary Press luncheon. Other representatives of the London and North Western Railway present included Mr. Charles Chitty (head of the expenditure department and secretary of Superannuation Fund), Mr. E. Wharton (District Goods Manager, Birmingham), Mr. H. W. C. Palmer (Supervisor of the Refreshment Rooms), Mr. E. T. Townsend (Resident Engineer for the new works at Nuneaton), Mr. W. B. Farr (District Engineer), Mr. F. Hare (Publicity Department), Mr. R. Wynn Owen (Architect), Mr. A. Boyce (District Goods Manager, Rugby), Mr. G. A. E. Green (Passenger Agent at Coventry), Mr G. T. Sear (Goods Agent at Nuneaton), and Mr. E. Wright (Stationmaster at Nuneaton).

Mr. Grasemann's Remarks.

After the lunch Mr. Grasemann proposed "Prosperity to Nuneaton," but before doing so he expressed, on behalf of the Directors of the London and North Western Railway Company, their sincere sympathy with those who had lost their husbands, sons, and brothers in the recent dreadful colliery disaster at Exhall. He sincerely hoped that public-spirited Nuneaton would generously help those left behind. Mr. Grasemann then referred to the remarkable growth of Nuneaton, now the third largest town in Warwickshire, and from the last census returns showed an increase from 10,000 to 40,000. Thirty distinct trades are represented there, and new factories are being built for the manufacture of needles and dyes, and whilst congratulating the railway company on their enterprise in rebuilding the station, he congratulated Nuneaton on its present position, there being no better proof of its progress than the extensive alterations the Company had found it necessary to make. From an architectural point of view he thought all would agree that the buildings, so far completed, were a credit to the town. Great credit was due to Mr. Wynn Owen, the architect, who had just completed a most important addition to the Euston dining rooms. In proposing the toast, he said how much obliged he was to them for their presence, and hoped the dining room would prove an additional attraction to the town. He also referred to Miss Abbott, the manageress, and her assistants, whom he said would provide a luncheon similar in character to the one they had had that day at all times.

Mr. Chitty proposed "The Press," and expressed the pleasure it gave them to see such a representative number present. Mr. A. C. Slade responded, referring to the progress Nuneaton had made from a sleepy village to becoming a gradually expanding borough.

Flooding in the Highlands.

The end of September witnessed unprecedented flooding in the Highlands, due to excessive

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rainstorms, and the Highland Railway suffered severely. The rain set in at a very early hour on Saturday morning, September 25th, with the wind in the north-east. As the morning and the day advanced, the rainfall increased, and during Saturday afternoon and night it was torrential. During the early hours of Sunday morning there was an apparent increase in the rainfall, and it was then that most of the damage and destruction was done, damage which was on a scale unprecedented in the North. As the result of the rainstorm there was practically no communication for some time between North and South. Railway traffic was brought to a standstill owing to various bridges and culverts being swept away. When the mail train from the South arrived at Aviemore on Sunday both routes to Inverness were blocked against it. The train made its way to Forres, where it remained on Sunday and Monday. Further progress was prevented by a serious fissure in the line at Brodie, where a bridge had been swept away, along with a large part of the railway track and a signal cabin. There was also a breach in the same track near Allanfearn station, and minor damage by flooding that rendered the line useless for the time being. Trains to Elgin could not get past Garmouth, and the harbour works at Buckie were badly damaged.

Inverness Isolated.

A SERIOUS breakage of the Aviemore–Inverness line about a mile from the latter place prevented trains from taking the short route. A great gap was formed in the railway embankment. The down line of rails was snapped after losing its support, and the up line hung with its sleepers in mid-air. The track was damaged for a stretch of over 100 yards. A squad of soldiers assisted the surfacemen in filling up the embankment and repairing the damage to the track. Railway communication with the South was soon restored, and the ordinary service of trains over a deviation line was resumed on the Tuesday morning. Railway communication east of Nairn took longer to establish.

Disastrous flooding occurred at Nairn and Forres. Several large and important bridges were washed away, and considerable damage was done to roads and crops. The bridges carried away include the Cawdor Bridge and the Jubilee Bridge at Nairn. On the Highland line, traffic had to be suspended between Inverness and Keith. Railway passengers were motored from east and west to Forres to join the south-going trains. On the northern section of the line near Bonar Bridge a large culvert was carried away.

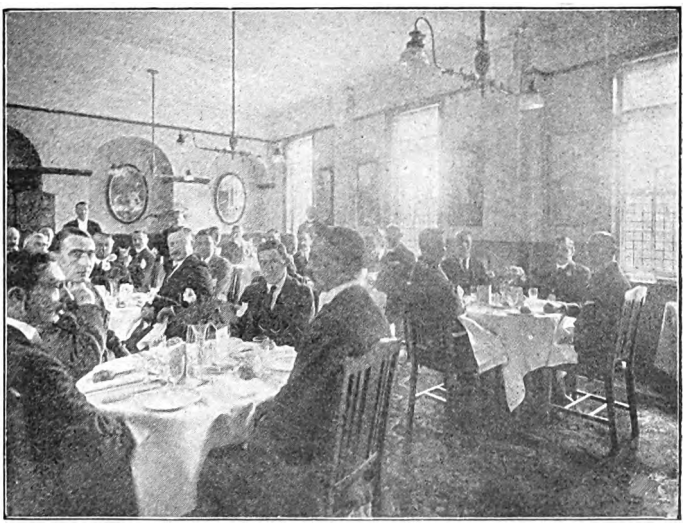
Progress of the Shildon and Newport Electrification: North Eastern Railway.

EXPERIMENTAL working on the electrified portion of the North Eastern Railway from Shildon to Newport has commenced, and it is expected that the whole of the Simpasture branch from Shildon to Erimus sidings, Newport, near Middlesbrough, will be opened for traffic almost immediately. Several factors determined the selection of this particular line for the experiment. It is really part of the old Clarence Railway, constructed about 1833 by some capitalists in Stockton, to compete with the Stockton and Darlington Railway, to run from a junction with the latter railway at Simpasture to Port Clarence. With the exception of the section from Stillington to Carlton, on the line from Stockton to Ferryhill, it is entirely a mineral railway. There are no steep gradients and no engineering features which would make difficult its electric equipment. It in no way intersects a passenger line, with the short exception mentioned, but it provides a special class of traffic from which the working results will be easily ascertainable without complications.

The starting point, Shildon, is the collecting ground for the West Durham coalfield, and virtually the whole of the output carried over the line is intended to feed the enormous blast furnaces which are built beside the line at Erimus Sidings, between Thornaby and Middlesbrough. There is no remarshalling *en route*, the "lead" being continuous and direct.

The Electrical Equipment.

CURRENT is collected by the overhead system, and conducted by two bows from the overhead



OPENING OF NEW DINING ROOM AT NUNEATON, LONDON AND NORTH WESTERN RAILWAY. THE PARTY AT LUNCH.

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rail to the locomotives. Ten engines will be employed, nine of which are completed, and have made experimental runs. They are of the usual double-bogie type, with motors to each axle. They have been designed by Mr. Vincent L. Raven, Chief Mechanical Engineer, North Eastern Railway, and built at the Darlington Works. Each locomotive is capable of hauling a load of 1,000 tons. The line falls slightly from Shildon to Erimus, and average loads of 1,000 tons will be taken on the outward journey; the steepest gradient on the line is 1 in 100, and the average return load will be about 575 tons. A special engine shed has been erected at Shildon to accommodate the locomotives.

The electrical equipment has been designed and carried out under the supervision of Mr. Chas. A. Harrison, who has recently retired from the position of Chief Engineer of the Company. Power is supplied by the Newcastle-on-Tyne Electric Supply Company, and the Cleveland and South Durham Companies, who have erected sub-stations to convey the power, the current being 1,500 volts. Wires conveying the current are suspended from standards, and except under bridges, have a clear headway from rail level of about 17½ ft. The double line has been electrified for its whole length, and there are in addition several sidings electrified at Erimus and other places. Several trains are being run daily over a short section of 8 miles between Simpasture Junction and Bowesfield.

New Lothian Lines: North British Railway.

In our September number particulars were given of this comprehensive scheme of new lines. These were brought into use on Sunday, September 26th. The North British Railway has a virtual monopoly of traffic east of the Pentlands and the docks at Leith, at which the great bulk of the Lothian coal output is shipped. Prior to the outbreak of war the coal and coke conveyed by rail from collieries in the Lothian coalfields had reached no less than 3,653,938 tons per annum, as against 1,739,107 tons in 1903, being an increase of no less than 110 per cent. The North British Company has all along been active in providing for this immense development, and, in addition to the lines now concerned, they have also carried out other important extension and improvement works, such as the widening and extension works in the Portobello district, completed in 1909, and the South Leith branch, extending from Portobello to the docks at Leith, a distance of about 2 miles, which has been doubled, as also the line between Monktonhall Junction and Smeaton. In 1904 the passenger service on the South Leith branch was entirely withdrawn.

The new railways have several interesting features, and the system of working which has been adopted is of special note. The double lines between Monktonhall Junction and Wanton Walls Junction are used for goods, mineral, and other trains, passenger trains being excluded, and are worked in accordance with the ordinary regulations for train signalling by block telegraph on double lines of railway. The block telegraph sections are:—(1) Monktonhall Junction and Wanton Walls Junction; (2) Wanton Walls Junction and Niddrie West Junction. The old double lines between Niddrie East Junction and Wanton Walls have been closed, and all traffic between Niddrie West and Monktonhall is now worked by the new double lines. In the case of the new single lines between Wanton Walls Junction and Brunstane Park Junction, the working is regulated by means of Skyes' single line lock and block apparatus or non-token system. In this system the signals are controlled by means of electric treadles placed at suitable positions on the permanent way, and these are operated by the wheels passing over them. The signals controlling the section thus cannot be lowered until the train quitting the section gives the necessary relief by passing over the relief treadle applicable to the section. The signals accordingly are locked in such a way that it is impossible for the signalman to lower the starting signals for either direction when a train is in the section. Time is also saved by the arrangement, as engine drivers do not require to handle any tablet or staff as is the case before entering sections worked by means of tablet or train staff.

The Quintinshill Accident.

It is not our practice to deal with railway accidents *in extenso*, except from the point of view of factors of railway importance which may be raised and matters of interest in respect of traffic working methods and suggested safety measures. This terrible disaster appears, however, to call for more detailed attention and for a few remarks. The trains concerned were made up as follows:

(1) 6.10 a.m. *ex*-Carlisle (6.17 a.m. working book). Three Caledonian Railway bogies and a six-wheeled milk van; 4–6–0 engine No. 907 ("Cardean" class).

(2) Special troop train from Larbert. Four Great Central Railway bogie coaches and 11 Great Central Railway six-wheelers, for passengers; and five Caledonian Railway six-wheelers (two caravan trucks, two fish vans, and brake van), and one Caledonian Railway open scenery bogie truck, making 21 vehicles (= 23½) in all. 4–4–0 engine No. 121.

(3) 6.5 a.m. West Coast express. Three 12-wheelers and 10 bogies. 4–4–0 engines Nos. 140 and 48. There were two collisions, about one minute apart, first of the troop train and the local, and then of the West Coast express with the *debris*. In addition, two goods trains in sidings were involved by the wreckage.

The carriages of the 6.5 a.m. express, with the exception of the rear brake composite, had underframes composed entirely of steel; the rear brake had channel steel sole bars and headstocks, but oak longitudinals, diagonals, etc. The Great Central carriages of the troop train had oak underframes, with steel sole plates, excepting the first, eighth, eleventh, and fifteenth, which had steel underframes.

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In the local train one vehicle was gas lighted, the others being electric. In the troop train 12 of the passenger-carrying vehicles were gas lighted, three having electric equipment, while in the West Coast express nine had electric light and four gas equipment.

Value of Emergency Equipment.

THERE was a good stock of tools, extincteurs, and other emergency equipment on the express. There were also five fire extincteurs in sleeping saloons and sleeping composites (one in each). There were no fire buckets in the emergency equipment in this train, but it is now the practice of the London and North Western Railway, who maintain the West Coast Joint stock, to supply two fire buckets in all the main line open vans and larger brake ends as the vehicles pass through the works. The tools in the troop train consisted of: Two extinguishers, two refills for same, two axes, two saws, two long pinch-bars, two small pinch-bars, two water buckets (*i.e.*, one of each of the articles mentioned in each of the two brake compartments). The brake-van of the local train was also equipped with: One fire extinguisher, one hand-saw, one fore-hammer, one chisel, one hand-lamp, one hand hammer, one pinch bar, one fire bucket, one collapsible ladder.

From this point of view the trains were well supplied, and the equipment fully justified itself on this occasion.

Moreover, while there is little doubt that had the troop train been made up of more modern vehicles the results would have been less serious, it has to be remembered that it must take a considerable time before steel underframes can become universal, and it is one of the necessities of the present situation that many older vehicles must be utilised for traffic, both ordinary and special. Furthermore, the Inspector adopts the view that the fire was probably due to fuel from the engines' fireboxes, and that while gas may have fed it somewhat it was not a prime factor in the disastrous results which followed this accident.

The Results of the Accident.

EACH collision was of a very severe nature, and the driver, F. Scott, the fireman, J. Hannah, and a large number of the officers and men of the 1/7th Royal Scots, who were travelling by the troop train, were killed; five officers in the 6.5 a.m. express also lost their lives. The details of those killed and injured in each train are given as follows:—

FATAL.

In troop train—		
Non-commissioned officers and men killed and identified	57	
Non-commissioned officers and men since dead	26—	83
Other bodies recovered but not recognisable		82
Reported missing in addition by Military Authorities who cannot say definitely that figures are absolutely correct, Battalion Roll having been lost in accident. Figures were compiled from Roll Call made from information available at Scottish Command and may be regarded as very nearly accurate—		
Officers	3	
Other ranks	47—	50
In 6.5 a.m. express—		
Passengers killed	5	
Passengers since dead	2—	7
In 6.17 a.m. local train—		
Passengers killed		2
Railway servants killed—		
On troop train	2	
On 6.5 a.m. express	1—	3
Total		227

INJURED.

Passengers in troop train injured—		
Officers	2	
Other ranks	189—	191
Passengers in 6.5 a.m. express injured		51
Passengers in 6.17 a.m. local train injured		0
Railway servants injured—		
On 6.5 a.m. express	3	
On troop train	1—	4
Total		246

The fire spread rapidly and was soon burning fiercely, and in spite of the efforts of those on the spot spread to the whole of the troop train, with the exception of the six detached rear vehicles, and all the 15 coaches were entirely destroyed. The front coaches of the 6.5 express also became involved after about half an hour, and the four leading coaches were also destroyed by the fire. All four engines and tenders were also generally damaged by fire, and all the coal left in the tenders after the collision was consumed. Seven wagons of the goods train in the down loop were also destroyed, and one had the upper body partly burned. Five wagons of the empty wagon train in the up loop were destroyed, two were partially burnt, and two damaged.

It is pointed out that the wreckage of the troop train was so excessive that probably all those not rescued before the fire reached the coaches in which they lay were dead, or, at any rate, insensible, so it may be confidently hoped that few, if any, were conscious when the fire reached them.

Placing the Responsibility.

THE evidence is substantially what has been stated in the press accounts of the inquiry, of the inquests, and the trial of the railwaymen. This evidence is fully discussed by Lieut.-Col. Druitt, who places the responsibility entirely upon the two signalmen, G. Meakin and J. Tinsley, as all signals were lowered for the troop train at the time of the first collision, and for the express. Meakin crossed the 6.10 a.m. local train from the down to the up line, and it was unquestionably

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his duty to have protected it, both by sending the "Blocking Back" signal to Kirkpatrick, and also by placing a clip on the up home signal lever, before handing over his duties to Tinsley. He also should have given the "Out of Section" bell signal to Kirkpatrick for the empty wagon train, which he had placed in the up loop line (as he had done all other signalling in connection with it), as soon as he replaced the points and the up loop home signal. Tinsley should have seen that the 6.10 a.m. local train was properly protected, as he was fully aware that it was standing on the up line, but his attention was probably taken up by making the numerous entries in the register, owing to the arrangement between the two men whereby Meakin kept a separate record of train movements after 6 a.m., when Tinsley should have relieved him, the latter then entering them in the train register, and also in dealing with the signalling of the two expresses.

G. Hutchinson, the fireman of the 6.10 local train, came to the signal-box to carry out Rule 55, and signed his name in the register in accordance with the instructions. Tinsley saw him do this, but although Hutchinson remained in the cabin some 4 minutes before returning to his engine he neglected to get an assurance from Tinsley that his train was protected by a collar being placed on the lever of the up home signal, as he should have done.

Lieut.-Col. Druitt expresses the decided opinion that this disastrous collision was thus due to want of discipline on the part of the signalmen, first by changing duty at an unauthorised hour, which caused Tinsley to be occupied in writing up the train register book, and so diverted his attention from his proper work; secondly, by Meakin handing over the duty in a very lax manner; and, thirdly, by both signalmen neglecting to carry out various rules specially framed for preventing accidents due to forgetfulness on the part of signalmen.

Routine Work on Railways.

THE Inspector then passes a few remarks on the general facts of this accident and the conditions and occurrences which caused it. He points out that men engaged in routine work, where the conditions may easily become dangerous either to themselves or others, sometimes get into a loose way of working, and habitually neglect regulations which have been laid down for their own or others' protection. In regard to track circuits, Lieut.-Col. Druitt admits that while it would have almost certainly prevented this accident, Quintinshill would probably have been one of the last places to be equipped therewith. He considers that the means provided at the present time by the Company for reminding signalmen of any vehicles standing within their control at such a place as Quintinshill should have been sufficient, if the signalmen concerned had only carried out the ordinary simple rules of block working and regulations laid down for the purpose, and paid proper attention to their duties.

To some extent, too, the influence of the war must be allowed for. The Inspector mentions that he is informed that the traffic on the Caledonian Railway into and out of Carlisle has lately been 40 per cent. greater in each direction than it was 10 months ago, so that the traffic conditions have been quite exceptional.

Practical Factors involved.

LIEUT.-COL. DRUITT remarks in conclusion as follows:—

"The circumstances attending this disastrous collision, as far as the troop train is concerned, were altogether exceptional, so with regard to suggestions for preventing the terrible results arising from fire breaking out in wreckage after a bad collision I need only refer to the recommendations already made in previous accident reports. The principal of these for coaching stock on main lines and for express trains are:—

"(1) The construction of the coaches to be of steel as far as possible, with shock-absorbing buffers, and any timber or other combustible material used to be rendered non-inflammable. Special attention to be paid to the construction of the doorways, so that the doors shall not jam when a collision occurs. Bars across windows to be easily removable, and windows to be capable of being opened to their fullest extent.

"(2) The provision of electric lighting in all new stock, and gas lighting in existing stock to be abolished and electric lighting to be provided as opportunity admits.

"(3) The provision of tools and appliances for extinguishing fires, in all brake vans, sleeping saloons, etc.

"With regard to the action taken by the railway companies in these matters:—

"(1) I understand that some of the principal companies are carrying out the recommendation as to rendering timber used in carriage construction non-inflammable.

"(2) Most of the principal companies are providing electric light in all new carriage stock, and some are arranging to convert existing gas-lit stock as opportunity occurs, but this must necessarily be a slow process spread over many years.

"(3) All express trains are, I believe, now provided with tools and appliances for extinguishing fires."

Acknowledgment of the valuable service rendered by uninjured soldiers in the troop train and by soldiers and naval men in the express, is made; also of the co-operation of the Carlisle Fire Brigade and of local doctors. The water difficulty was a considerable one, owing to the locality and the fact that several of the engine tenders were damaged by the collisions, so that their tanks emptied. Some of the emergency appliances were not available owing to their being included in portions of the trains which suffered most. Several of the railwaymen adjacent also rendered very valuable services, especially those of the goods trains adjacent, and one of the bright features of this terrible disaster is the intelligent action taken by men on all trains concerned as far as they were able.

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General Remarks.

We understand that a movement is on foot to obtain a mitigation of the sentences imposed upon the two signalmen who share the responsibility for this disaster. In a large degree one must sympathise with them—they have been punished terribly for a fault which had not a particle of intention, and whose culpability is a moot question, seeing that the results far transcend the severity of the offence. Indeed, in ordinary life corresponding offences are common, but conditions allow of their being remedied, or do not cause widespread difficulties; yet these men will have hanging over the rest of their lives the burden of this unprecedented death-roll laid at their doors—to any one, and more especially to a sensitive person, a punishment which renders a sentence of imprisonment a mere detail. Yet it would never do to at once condone such an offence, for the essence of railway working is that instructions and rules and regulations must be obeyed; otherwise every railway would have to be one vast complication of safety devices, with the strong probability that excessive multiplication thereof would cause even more trouble. As we have before pointed out, the human element in railway traffic operation is not only a weakness, but also one of its strongest safeguards, and while Quintinshill is an instance where it failed to rise to the occasion—with results quite out of proportion to the offence—hundreds of others could be quoted where it has saved a situation.

Incidental Aspects.

Lt.-Col. Druitt is well advised in that he does not advocate this or that being done, for conditions are hardly likely to be paralleled in the future, and under present circumstances it would not be reasonable to ask for additional measures to be taken. He refers to several other matters, rather for the sake of doing so than as factors seriously involved. Thus it is not suggested that gas lighting had anything to do with the fire which followed; that relatively old vehicles with wood underframes were included in the troop train was due to the fact that with so many additional and special train movements it is not possible to use only up-to-date stock, and even then they might have been included for other reasons; and the equipment of emergency appliances appears to have justified itself, even although some of them were not available owing to their positions in portions of the trains which suffered most. As the Inspector points out, electric lighting is now being far more generally installed, and it is an open secret that at least one of the leading railways is carrying out the policy of universal electric lighting, equipment being spread over ten years, two of which at least have already elapsed. More than this would be unreasonable, and it evidences a tendency which is largely indicated also on other lines. Similarly, as old stock is withdrawn and more modern designs become universal, there will be fewer and fewer vehicles in important service with wooden underframes, while steel construction is making some headway and fireproof treatment of body timber is becoming fairly general. In conjunction with the provision of anti-telescoping buffers, and other measures which are now being adopted more or less generally, every year reduces the liability to disastrous collision results.

The Closing of the Redruth and Chasewater Railway.

NOTICE IS HEREBY GIVEN that in pursuance of the directions of the Vacation Master in the Chancery Action of Barlow v. The Company (1879 B. 307), this Railway will be ENTIRELY CLOSED and will CEASE WORKING on Saturday, the 25th of September 1915; and no goods or other traffic will be accepted for transit nor any business transacted after that date.

The above notice was issued by the Receiver and Manager under date of September 1st. The Company was first constituted by Act of Parliament in 1823; it has thus been existent nearly a century. It was reorganised by an amended Act in 1858. Originally the railroad was worked by horses. It has a length of 10 miles and rolling stock consisting of 3 locomotives and 90 goods vehicles.

Writing in the *West Briton and Cornwall Advertiser*, Mr. S. Michell, of Hayle, gives some reminiscences of this interesting railway:—

"When the line was constructed and until about the year 1870, the districts which it traversed contained some of the richest and most extensive mines in the county. It connected Wheal Buller, Copper Hill, and other mines to the south and west of Redruth, and the vast mining region of Consols, Ale and Cakes, United, Clifford, and other setts (afterwards Consolidated, and known as Clifford Amalgamated Mines), Nangiles, and other ventures with the port of Devoran, whence they were supplied with coal and other materials, but chiefly the former; copper ore was loaded back. In its course it traversed the Bissoe Valley, skirted the United Mines on their northern boundary, cut through the village of Carharrack, then along the foot of Carnmarth, and, passing Lanner, reached its terminus about two miles beyond.

"I remember two of the old engines, *Smelter* and *Miner*, and another that bore the vengeful name of *Spitfire*. From Trevarth school to the line was just a five minutes' scamper over the downs, and many a time have we watched the trains go snorting up the line. There were sidings at Nangiles, Consols, and Carharrack, and possibly at other places.

"It may be remarked in closing that until the collapse of mining in the Treskerby, Scorrier, and Gwennap districts, about forty years ago, coal was conveyed from the port of Portreath by a horse-tram line to Crofthandy, the terminus. There was a considerable depôt at Wheal Rose. The line was constructed by Messrs. Williams and Co., of Scorrier, and was managed by the late Capt. Michael Michell and his brother, Joseph Michell, brothers of Mr. Henry Michell, purser of Wheal Rose, St. Day United, and other mines."

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Mr. Joseph Cartmell, Engineer, Maryport and Carlisle Railway Company, retired as from October 1st. He joined the company from the Midland Railway in 1874, as Superintendent of Way and Works, under Mr. Addison, then General Manager and Engineer. On Mr. Addison's retirement in 1884, Mr. Cartmell was appointed Engineer, and has served in that capacity since. Mr. Harold Brown, his assistant, has been appointed to succeed him. It may be added that the directors accepted Mr. Cartmell's resignation with great regret and at their request Mr. Cartmell has agreed to act as Consulting Engineer for a period of 12 months.

* * *

Mr. John William Jolliffe's long connection with the London and North Western Railway Insurance and Provident and Pension Societies, of which he was assistant secretary for nearly the whole of his forty-five years' service, first with the late Mr. L. H. Viner, and afterwards with Mr. C. F. Grasemann, was brought to a close on his retirement on superannuation on reaching sixty-five years of age on August 8th. He was associated with the Insurance Society from the time of its inception in 1871, and has seen it develop from a total of 12,000 members to nearly 57,000 at the present time. He shared prominently in the work of inauguration of the Provident Society in 1874, and of the Pension Society in 1883, and later in the amalgamation of these two societies ; and he took a responsible part in the many developments of the funds consequent upon the introduction of the Employers' Liability Act in 1881, the Workmen's Compensation Acts of 1897 and 1906, and the National Insurance Act, 1911, as well as in the arrangements for the Company's guarantee of the pensions from the Provident and Pension Society in 1912. His activities also included the institution of an Approved Section of the Provident and Pension Society under the National Insurance Act, which has reached a membership of 30,000, and of which he was afterwards appointed secretary.

* * *

To succeed Mr. J. W. Jolliffe as assistant secretary of the London and North Western Railway Insurance and Provident and Pension Societies, Mr. A. W. Wilcox has been appointed. Mr. Wilcox entered the Company's service in August, 1881, in the locomotive running shed at Camden. Having had constant and close contact with the operating staff and traffic arrangements for eight and a-half years, he was removed to the Crewe general offices in 1890 to take charge of a section engaged on operating statistics, and afterwards took over the departmental duties arising out of the Workmen's Compensation Acts, 1897 and 1906, including settlement of claims and County Court business, also Conciliation statistics and Provident and Pension Society matters and National Insurance (Health and Unemployment) arrangements. When at Crewe he took an active interest in the Mechanics' Institution, where he conducted classes in book-keeping and accountancy for many years, and also in other local institutions. He has for some time been specially interested in the working and improvement of London and North Western Superannuation Fund and Widows and Orphans' Fund, and has been a member of the Committee of Management for many years. He has organised many movements in connection with and on behalf of the salaried staff, and was mainly responsible for the formation of the Salaried Staff Special Assistance Fund.

* * *

Mr. D. C. Urie, Assistant to the Works Manager, Eastleigh Locomotive Works, London and South Western Railway, has been appointed First Assistant to the Locomotive Carriage and Wagon Superintendent of the Midland Great Western Railway of Ireland. Mr. Urie was articled to the late Mr. Dugald Drummond, and entered the service of the London and South Western Railway at Nine Elms in October, 1901. He served a practical apprenticeship in all the shops, also on the footplate, followed by seven years in the Drawing Office, during the last three of which he served as Leading Draughtsman. In 1913 he returned to the shops in the capacity of Assistant to the Works Manager. He had charge of all testing in connection with the shops and running of engines, and he was responsible for all running tests in connection with the superheating of locomotives.

* * *

The death is announced of Mr. F. Eustace Faithfull, Secretary since 1892 of the Buenos Ayres Western Railway, and widely known and respected in Argentine circles. During the period he was secretary the Buenos Ayres Western Railway has made many important extensions, and has done much to develop the resources of the districts served. Mr. Faithfull was one of the founders of the

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ELECTRIC LIFTS AT WAPPING: EAST LONDON RAILWAY.

Argentine Club, which has proved a popular centre for those associated with the Republic. Mr. Robert Graham, who during Mr. Faithfull's illness carried on his duties, has been appointed by the Directors secretary of the Company.

* * *

MR. LORD, who has been in charge of the passenger traffic at Dover for many years, has recently been appointed traffic superintendent, and now has control of all the railway business at Dover with offices at Dover Harbour station, Mr. G. Harnet, who has held the position of chief goods clerk at Dover Priory, has been appointed goods agent, and is responsible, under Mr. Lord, for all goods accounts and commercial business. Mr. W. B. Busbridge and Mr. W. G. M. Jarvis have been appointed stationmasters at Dover, and are also responsible to the traffic superintendent.

* * *

WE regret to record the death, which occurred suddenly in London on September 14th, of Colonel the Honourable Charles Ernest Edgcumbe, who had been a Director of the Great Western Railway Company for the past twenty-six years, prior to which he was a member of the Board of the Cornwall Railway, a line which was amalgamated with the Great Western in 1889. He was a member of several Great Western Railway Committees and of the Boards of the Princetown and West London Extension Railways. He was a J.P. for Cornwall and Devon.

* * *

TRACK circuiting is now in operation at Dorchester Junction, Great Western Railway. The system is applied in connection with the recently erected outer up "stop" signal, placed at a distance of (approximately) 800 yards from the signal cabin. This semaphore displays the usual intimation, illuminated by night, of the existence of an "indicator in cabin," dispensing, therefore, with the carrying out of Rule 55. The corresponding up distant signal is now placed at the Weymouth end of the Carne "halt," and is, therefore, located at a mile's distance from the junction signal box, saving four chains only. The signal is operated by power, and is lowered only in the case of up main line, viz., Great Western Railway trains, being passed at "danger" by all London and South Western Railway traffic, as well as by certain Great Western Railway trains, including local rail motors terminating at the Great Western Railway station. There are now thus five semaphore arms, operating from the junction cabin, applying to up Great Western Railway trains alone, whilst two of the said semaphores carry below them "distant" arms controlled by Dorchester Great Western Railway station box.

* * *

AT Upwey Junction station the former up starting signal no longer exists, a new track circuited semaphore occupying the position of an "advanced" starter in ordinary circumstances, albeit a "starting" signal in actual fact, is now in operation at a point approaching, or exceeding, 700 yards from the signal box. The notice above referred to is likewise exhibited from the signal in question.

* * *

MAKING appropriate use of the old song "Wapping Old Stairs," the Metropolitan Railway direct attention to the fact that the actual Wapping Stairs at the station of the East London Railway have now been superseded by modern electric lifts just installed there. Hitherto some 100 stairs had to be negotiated from the street level to the platform; now swift and commodious lifts carry thirty passengers each, and doing the distance of 55 ft. in a few seconds add to the comfort and convenience of the passenger. The latest word in safety is also spoken in the automatic gates and safety devices of these lifts. The lifts were brought into use on Monday, October 4th.

* * *

THE first of two petrol-electric cars ordered by the Dublin and Blessington Steam Tramways Company was put into operation recently. The cars should have been placed in service in May, and the bodies were ready, but the petrol engines were commandeered by the Government for war purposes when finished. This happened with several consecutive sets; hence the delay. The new cars were built by Hurst, Nelson & Company, Limited, of Motherwell, to the

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design of Mr. J. P. Tierney, C.E., Managing Director of the tramways, and they will each accommodate 75 passengers, besides hauling one of the existing steam cars as a trailer. With a view to running over the system of the Dublin United Tramways Company, the petrol-electric cars are so fitted that the two motors can obtain current from the trolley wire.

* * *

WITH the retirement of driver J. Pullen, late of superheater 4–4–2 engine No. 426, the London, Brighton and South Coast Railway loses one of its best known express men. Driver Pullen started railway work on the London and South Western Railway at Nine Elms early in the 'seventies, but after working there some time as engine cleaner left the service and joined the London, Brighton and South Coast Railway in March, 1873, first as engine cleaner and then as fire-lighter. He started as fireman in 1875 and passed for a driver in 1879. He has worked on all classes of trains, including pilot, local, goods and main line goods trains, as well as taking passenger trains and running main line special passengers, and Royal trains. He has also driven all sorts of engines, coupled and single-driver, from the smallest to the largest. But it will be best to let Mr. Pullen tell his own story:—"I have taken Royalty to many places on the Company's lines and also Royalty from other countries when paying visits here. I worked the Pullman train to Brighton, soon after it started—to Brighton in the hour, with No. 213 engine *Bessemer*, and with engine No. 42 *His Majesty*; also 'The Southern Belle.' The last few years I have had No. 426 engine, one of the 'Atlantic' class, and I may tell you I am proud of that engine, for it has done its work throughout without any trouble. I have left Victoria at 3.10 p.m. and arrived at Brighton with 11 or 12 bogie carriages on in the hour. I have worked the 12.20 p.m., 1.20 p.m. and 3.50 p.m. trains from Brighton to Victoria in the even hour, with 11, 12, and 13 bogies on, and have kept sectional time. I have taken these trains to and fro in 57 min. at times when required. I left the Company's service on the 16th July last."

* * *

THE UndergrounD Railways have just issued two more of their illustrated booklets on London. These deal with the Markets and the City Churches, and like the books on the Tower and the Zoological Gardens, recently issued, may be obtained free of charge. The London General Omnibus Co. has also brought out an exceedingly novel and interesting guide to London. It is entitled "A Tour Through the Centre of London by Motor-'bus," and consists of a booklet of twelve pages with 75 photographs. In tabulated form are notes of the places of interest covered by the tour. The booklet is virtually a history of London. Copies of these series of booklets may be had free of charge from the Advertising Manager, Electric Railway House, Broadway, Westminster, S.W.

2ND LIEUTENANT BASIL M. BAZLEY, 11TH BATT. NORTH STAFFS. REGIMENT.

LIEUTENANT BAZLEY, whose portrait appears on this page, is better known by his pen and stage name of "Basil Mercer," for in addition to producing highly commendable work as a writer on railway subjects, he has had no small experience behind the footlights. To the RAILWAY MAGAZINE Lieutenant Bazley has been a valued contributor, and at the outbreak of war on joining the Army he relinquished his services as instructor to the London and North Western Railway (Euston) Dramatic Society. Lieutenant Bazley is an Executive member of the Railway Club, Victoria Street, London, S.W.

* * *

ON the London and North Western Railway the last three "George V." class engines to be put in service are: No. 1086, *Conway*, stationed at Rugby; No. 2106, *Holyhead*, stationed at Crewe; No. 2370, *Dovedale*, stationed at Crewe. A series of ten 0–8–2 tank engines have just been put into service, thus making 20 of this type altogether. This new series bear the following numbers: 58, 482, 563, 736, 1090, 1124, 1414, 1514, 1515, 2277. From this list it will be seen that the following 2–4–0 "Jumbos" have recently been scrapped: 482, *Pegasus*; 736 *Memmon*; 1514, *Scott*; 1515, *Milton*.

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Also one of the 0–6–0 saddle tanks used at Euston station has been scrapped. No. 1414 witnesses the departure of another of Mr. Webb's 4-cylinder 4–6–0 compound goods engines. This class is now becoming very scarce. No. 1407, stationed at Nuneaton, being one of the very few now left. Two other 2–4–0 "Jumbos" have also been scrapped, namely: 90, *Luck of Edenhall*; 401, *Zeno*; also 525, another saddle tank.

* * *

THREE more of Mr. Webb's 4-cylinder 4–4–0 compound passenger engines have been converted to 2-cylinder simple, namely: 1945, *Magnificent*; 1948, *Camperdown*; 1961, *Albermarle*. There are now ten of these engines simplified, namely:

1905, *Black Diamond*, stationed at Chester.
1913, *Canopus* ,, ,, Rugby.
1918, *Renown* ,, ,, Stafford.
1921, *John o' Gaunt* ,, ,, Northampton.
1935, *Collingwood* ,, ,, Chester.
1946, *Diadem* ,, ,, Crewe.
1945, *Magnificent*.
1948, *Camperdown*.
1951, *Bacchante* ,, ,, Rugby.
1971, *Euryalus*.

* * *

ON the Great Eastern Railway a system of labelling the engines with a number, corresponding to a certain district, has been adopted. These labels are very similar to the shed plates of the London and North Western Railway, except that they have the word "district" written above the number. The railway is divided into ten such districts, namely:

1. London.
2. Ipswich.
3. Norwich.
4. Cambridge.
5. Doncaster.
6. King's Lynn.
7. Peterborough.
8. Harwich.
9. March.
10. York.

* * *

MIDLAND RAILWAY locomotives Nos. 700 and 768 (4–4–0) are fitted with the Weir feed pump and heater. No. 700 is stationed at Leicester and 768 at Derby. Further, No. 773, also stationed at Derby, an engine of similar type, has been running for some time with solid bogey wheels. Nos. 1000 and 1001, 3-cylinder compounds, have been rebuilt with cut-away splashers, and are now superheated. The only compound remaining, as originally designed, is 1002. All three engines are stationed at Leeds. No. 138 (2–4–0) is fitted with a tender cab.

* * *

THE UndergrounD Railways send copies of three of the latest posters which they are now exhibiting at various stations in London. A large 60 in. by 40 in. poster, entitled "The Crown of London," was drawn direct on to the stone by the artist, Mr. Joseph Pennell. This poster throws strongly into relief the dome of St. Paul's, with the Thames and Waterloo Bridge in the foreground, the whole making a stately and inspiring group, and when viewed from a distance, gives the true spirit of the scene. The companion bill to this picture is a double-royal poster, with a modern decorative design, which gives an appropriate quotation by Thomas Dekker, written it is thought somewhere about the year 1590. A double-royal bill, entitled "Memorials of Oversea," has been brought out with the desire to assist the large numbers of our oversea kinsmen at present in London to find the various places of their particular interest. The poster gives the nearest stations and motor-'bus routes, together with interesting sketches of the subjects dealt with.

* * *

THE Board of Trade recently issued a list of merchant seamen and fishermen detained as prisoners of war in Germany, Austria-Hungary and Turkey. The list includes the names of 26 men of the Great Central Railway steamer *Bury*, 27 of the *City of Bradford*, and 28 of the *City of Leeds*; 18 of the Lancashire and Yorkshire Railway's steamer *Dearne*, and 17 of the *Equity*; and 23 of the Wilsons and North Eastern Railway Shipping Company's steamer *Hull*.

* * *

IT is stated that the North Eastern Railway Directors have decided not to appoint a docks engineer in succession to the late Mr. Charles Watson at present, and that Mr. Charles F. Bengough, Chief Engineer, will, for the time being, take charge of the dock engineering work in addition to his own work.

* * *

IN the absence of Mr. W. Parker, President, through indisposition, Mr. J. F. Gairns opened the winter session of the Railway Club on Tuesday, September 21st, by a paper entitled "Some public impressions of railway problems." At the October meeting, Mr. C. A. Hunt read a paper on "The need for economy in passenger train traffic." On November 9th, Rev. W. J. Scott will deal with "The War's Ravages in British train services." Great regret has been occasioned by the official intelligence of the death in action of Lieut. Malcolm S. Blane of the Cameron Highlanders, one of the Club's most popular members. He was in the hottest part of the fight during the great battle in France in September, and the regimental chaplain states his death must have been instantaneous. Lochiel, his colonel, writing to the parents of Lieut. Blane, records that "he was loved in the regiment." This can be well understood by Railway Club members to whom he had greatly endeared himself by his wholehearted enthusiasm and his charming personality. A portrait and biography of the gallant young officer appeared in the RAILWAY MAGAZINE, August, 1915, page 162.

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MR. E. ROBINSON,
District Goods Manager, Great Eastern Railway, Cambridge.

RIPE experience in railway working will make the position of Great Eastern Railway District Goods Manager at Cambridge less arduous to the new occupant of the post—Mr. E. Robinson—than it would be to many a younger man. Mr. Robinson began railway life forty-two years ago as a clerk at Harleston. After service at Thetford, Bungay and Trowse in subordinate positions, he became Chief Clerk at the latter important station in 1878. Eight years afterwards he was made Goods Agent at Tufnell Park, London, and then promoted to be Chief Cattle Canvasser. In 1913 he succeeded Mr. Pownall as District Agent at Manchester, which office he held until his transfer to the district goods office at Cambridge on October 1st last. When Chief Cattle Canvasser, Mr. Robinson's duties carried him to all the chief markets in England and Ireland, and his genial manner made him particularly popular wherever he went. But it was in East Anglia he had the largest circle of friends, and there are not a few who are rejoiced that he is once more back in the Eastern Counties. Mr. R. B. Ellis succeeds to the Manchester agency.

* * *

CONTINUING the useful work which the Great Eastern Railway Musical Society took up last season, the orchestra (numbering 70), comprised of those whose duties with the Company require them to remain at their posts, visited the Woodcote Park Convalescent Hospital on October 6th and gave a concert in the large Recreation Hall before an audience numbering over 1,500. The various instrumental items, together with the vocal efforts of Miss Annie Bartle (soprano) and Mr. Walter Barker (humorist), were much appreciated, and at the close of the proceedings Lord Killanin, Hon. Secretary of the Local Recreation Committee, expressed the thanks of those present to Colonel William Johnson Galloway (the Society's Hon. Conductor) and to the members for the very enjoyable entertainment they had provided. Further concerts of a similar nature were given on October 14th at the Crystal Palace, October 19th at the Town Hall, Chatham, and elsewhere.

* * *

IN accordance with their annual custom, the North British Railway Company have again distributed the sum of £400 among their best-kept stations. There were twenty stationmasters who received each the sum of £4 on account of their stations being in the first-class section; forty received £3 as second-class prizes; sixty received £2 for the third-class section; while eighty stationmasters each received the sum of £1, as the prize for those whose stations came under the fourth-class category.

* * *

REFERENCE was made, some time since, to the disappearance of the London and South Western Railway staff from Weymouth station. As a set-off, it may be mentioned that at Yeovil Town station the process has been reversed, the staff at that point now being that of the London and South Western Railway only.

* * *

THE London and North Western Railway district traffic superintendent's office at Shrewsbury has been closed, and goods matters previously dealt with there will, with certain exceptions, henceforth be dealt with by Mr. F. P. Kinsman, District Goods Manager, Crewe. Stations Coalport to Stafford (including Wellington) are now under the supervision of Mr. T. H. Shipley, District Goods Manager, Wolverhampton.

* * *

THE retirement of Mr. E. A. Scaife from the service of the Great Western Railway Company is announced. Mr. Scaife has occupied the position of Goods Manager of the Plymouth and Western district since 1904, and was before that District Goods Manager at Worcester and at Birmingham.

* * *

GREAT NORTHERN RAILWAY time tables dated July 12th, 1915, with certain exceptions, remain in force during October. Such alterations as are made are of a detail character, but the whole of the London suburban services have been revised owing to the closing of Holloway station, as already announced.

* * *

MR. THOMAS JOSEPH CALLAGHAN, J.P., of Penarth House, Penarth, has been elected a Director of the Barry Railway Company in the

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place of Mr. John Howard Thomas, a Director of this Company since its inception, who has now resigned.

* * *

Mr. Thomas Chew has been appointed solicitor to the Great Eastern Railway in place of Mr. Edward Moore, who has retired. Mr. Edgar Harry Wybroo has been appointed assistant solicitor.

* * *

Mr. S. J. Tatem, chief of one of the most successful fleets of "tramp" steamers attached to Cardiff, has joined the Board of the Cardiff Railway Company.

* * *

Deep regret will be felt at the death of Major the Hon. Myles Ponsonby, M.V.O., Grenadier Guards, second son of the Earl of Bessborough, Chairman of the Brighton Railway Company, who has been killed in action in France.

* * *

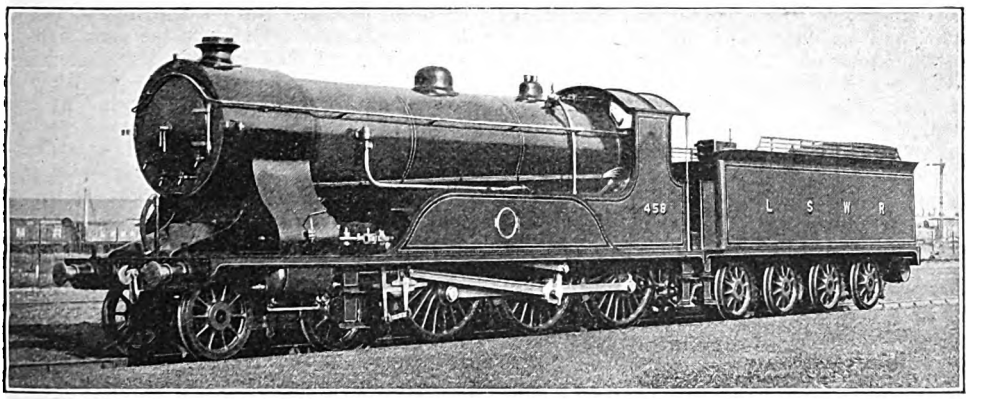
Great Central Railway 9.50 a.m. through Sunday train from Sheffield to Cardiff and Swansea will, commencing November 1st, run only as far as Didcot, there connecting with Great Western trains. The return train, replacing the 10.38 a.m. from Swansea to Sheffield, will leave Didcot at 3 p.m.

The London and South Western Railway announce that Gosport Road and Stokes Bay stations will be closed from November 1st until further notice.

* * *

On Saturday, October 16th, it was announced that an agreement had been made at the conference on the war bonus question between the railway companies and the representatives of the men's unions. The agreement provides: employés of 18 years of age and upwards will now receive a uniform bonus of 5s. per week; boys under 18 will receive 2s. 6d.; the first payment of the revised bonus to be in respect of the week ending Oct. 23rd; the agreement to remain in force until the Government relinquishes control of the railways, and then subject to one month's notice on either side; the men's unions undertake that during this period they will not present fresh demands of any kind, and that they will not give countenance either to a demand to re-open the settlement or to any strike for such an object. The bonuses include those previously made, the men benefiting by the differences between the original increases and the totals now provided for.

REBUILT LOCOMOTIVE No. 458: LONDON AND SOUTH WESTERN RAILWAY.



In carrying out his policy of developing locomotive practice on the London and South Western Railway, Mr. R. W. Urie has now taken in hand one of the large 6 ft. 6 in. 4-6-0 engines of the 443 class, designed by the late Mr. Dugald Drummond, No. 458 now concerned being one of the later series of this class fitted with Mr. Drummond's "steam dryer." The principal alterations are the provision of an extended smokebox to accommodate an "Eastleigh" superheater, the removal of the cross water tubes in the firebox and the introduction of large flue-tubes to accommodate the superheater elements. Two Detroit sight-feed lubricators have also been provided, each having four feeds, there being four cylinders with four piston valves on the engine. A pyrometer connected to the steam chest, and with an indicating gauge in the cab, is included.

Leading dimensions are now:—

Cylinders	15 in. × 26 in. (4)
Coupled wheels	6 ft. 7 in.
Steam pressure	175 lb.
Heating surface—	
Small tubes (2 in.)	873 sq. ft.
Large tubes (5¼ in.) ..	407 ,,
Firebox	158 ,,
Superheater	269 ,,
Total	1,707 ,,
Grate area	31·5 ,,
Weight in working order ..	75 tons 15 cwt.

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Railway Literature.

PRACTICAL RAILWAY WORKING. [By Charles Travis, David R. Lamb, and John A. Jenkinson. Crown 8vo, cloth, 326 pages. With numerous illustrations. London: The Boswell Printing and Publishing Co., Ltd., 91, Temple Chambers, Temple Avenue, E.C. 3s. 6d. net. 3s. 10d. post free]. This volume, which follows other volumes dealing with railway economic and operating subjects by these three authors, explains the functions of the various operating departments, and discusses some of the problems encountered in the everyday work of the railroad. The subjects dealt with in the various chapters are: I.—Preliminary Analysis; II.—Permanent Way Maintenance and Renewal; III.—Station Design and Lay-out; IV.—Arrangement of the Train Service; V.- Control of Locomotive Running; VI.—Distribution of Freight Rolling Stock; VII.—Operating Principles: Passenger Trains; VIII.—Operating Principles: Excursions; IX.—Operating Principles: Freight Trains; X.—Operating Principles: General; XI.—Control of Train Working; XII.—Traffic Administration; XIII.—Dock Administration and Working; XIV.—Railway Organisation. The book may be divided into the three sections of (1) Factors directly influencing railway operating, (2) Principles of railway operating, and (3) Organisation and administration of the operating departments. With numerous photographs and diagrams, the authors detail the requirements of the accommodation, follow on with the arrangement of the motive power and the provision of the rolling stock to the actual manipulation of traffic, and conclude with a description of the methods of control. A comprehensive index adds to the value of an excellent work which can be recommended not only to railway students, but to all whose business is connected with railway working.

* * *

THE RAILWAY LIBRARY, 1914. Compiled and edited by Slason Thompson, Director of the Bureau of Railway News and Statistics, Chicago. The new volume of this now well-known annual includes a reprint of a number of important articles collected from various sources, and a statistical section relating to American railways, and sections dealing with railways elsewhere, which is of considerable value. The volume opens with an illuminating chapter from Seymour Dunbar's "History of Travel in America," just from the press. This deals with stage coaching in the days just before the railway came with a rush to displace all other means of long distance land transportation. Following this comes the prospectus of an Illinois railroad which solicited subscriptions to stock with tempting promises of 25 per cent. returns on the investment. This prospectus bears date within ten years of the stage coach period described by Mr. Dunbar. A series of articles is then given dealing with the railway problems and pressing needs of the American railways of the present. Next follows an instructive series of papers on railway valuation and taxation. The subject of Government ownership is treated of in broad lines by Seth Low, W. M. Acworth, and ex-Senator Jonathan Bourne, jun., while R. H. Tingley furnishes a comprehensive review of the world's experiences with this alluring substitute for the best transportation system in the world. Naturally "The Railway Library" for 1914 devotes considerable space to the part the railways are playing in the war that is devastating Europe. As in former issues, the concluding chapter of "The Railway Library" consists of the annual report of the Bureau, of Railway News and Statistics in which is presented the latest information in regard to American and foreign railways.

* * *

MESSRS. E. MARLBOROUGH & CO. send a volume of their "Self-Taught" Series. This deals with the Russian language, by Major C. A. Thimm, revised by J. Marshall, M.A., late of Petrograd, and now issued in its fifth edition, entitled, "Russian Self-Taught" (cloth, 2s. 6d.; paper, 2s.). It contains Naval and Military vocabularies and phrases, as well as material suitable for commercial use.

* * *

THE LAW RELATING TO THE CARRIAGE BY LAND OF PASSENGERS, ANIMALS, AND GOODS. By S. W. Clarke, of the Middle Temple, and the North-Eastern Circuit, Barrister-at-Law. [Sir Isaac Pitman and Sons, Ltd. Price, 7s. 6d. net.] There is hardly a branch of the law that so often concerns the citizen in his everyday life as does that relating to the conveyance of passengers and merchandise. Everyone travels nowadays, and most people, certainly all business men, depend in a greater or lesser degree upon the due performance by railway companies and other carriers of contracts to carry goods punctually and safely. Questions about tickets, luggage, delay of trains, and responsibility for loss, damage, or injury, which constantly arise, can be solved by a reference to this volume, which states concisely, and in plain, non-technical language, the statutory and case law relating to the carriage by land of passengers, animals, and goods. Though primarily intended for use by business men of all classes, the needs of students for commercial law and other examinations have not been overlooked, while the profuse references to the authorities for the various propositions of law will, it is believed, make the volume of real assistance to the practising lawyer. Head-notes to paragraphs and a full index, with separate tables of statutes and cases, facilitate reference to any particular point.

* * *

WE have received from The Locomotive Publishing Company, Ltd., copies of two new sectional charts of locomotives for the Mashonaland Railway. One is of the 4-8-2 type and the other a 4-8-0, both showing clearly all constructional details. The price is 1s. each.

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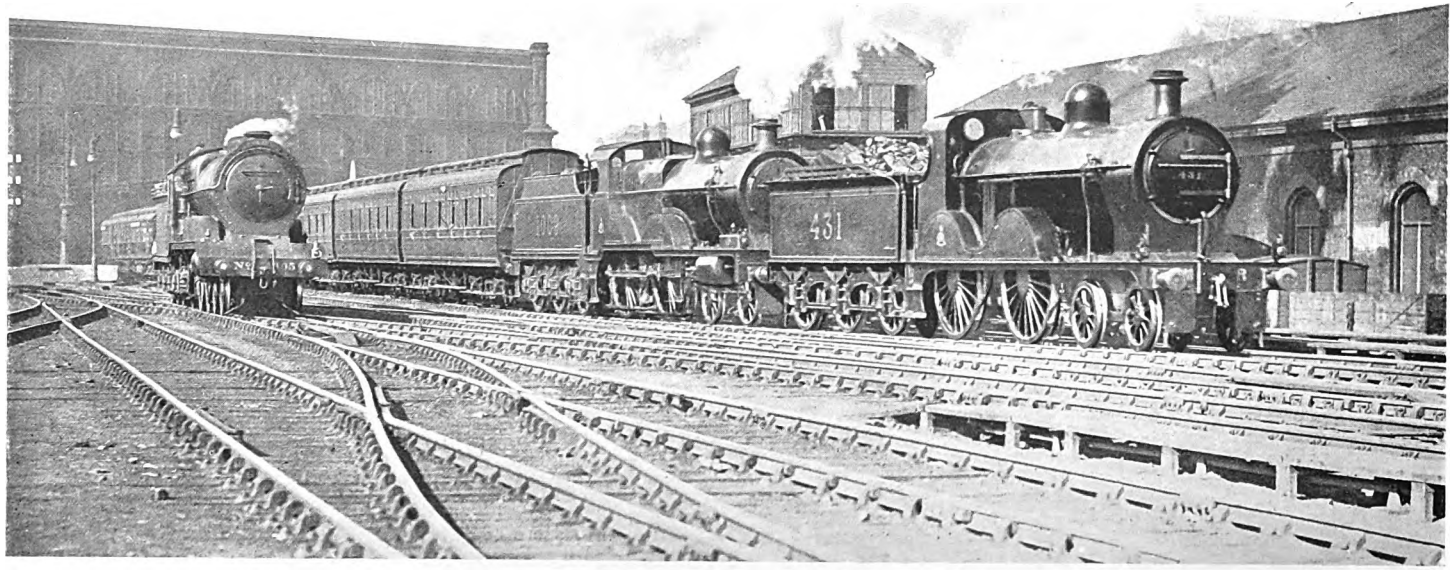

Photo] [*F. E. Mackay.*

MIDLAND RAILWAY.

10.30 a.m. Edinburgh-St. Pancras Express leaving Carlisle.

4-4-0 locomotive No. 431 and compound No. 1009.

The North British locomotive included in the photograph had brought the train from Edinburgh.

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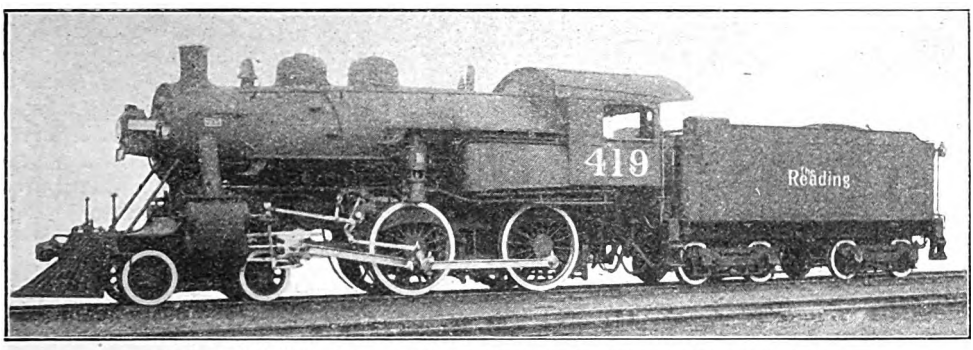

MODERN 4-4-0 LOCOMOTIVE: PHILADELPHIA AND READING RAILWAY.
Built by The Baldwin Locomotive Works.

Recent American Locomotives for Passenger Service.

A STUDY of the development of the American passenger locomotive, during the past few years, shows a remarkable advance, not only in the weight and capacity of the engines, but also in their efficiency. This development has been rendered imperative because of the increasing weight of trains and the more exacting nature of the service requirements. The steel cars used to-day frequently weigh upwards of 150,000 lbs. each, and where trains of 12 or 15 cars are hauled the total weight back of the tender may approach, or in some cases even exceed, 1,000 tons. Moreover, while there has, during recent years, been little tendency to increase the average speed of trains, there has been a decided tendency to limit maximum speeds with a view to preventing accidents. Thus the "safety first" movement, while of great benefit to the railroads, has imposed increased demands on the locomotives, as it necessitates higher average speeds on ascending grades and difficult sections of line in order to maintain schedules.

Twenty years ago the greater part of the passenger traffic on American railways was worked by locomotives of the 4–4–0 type; and where train loads were too heavy for locomotives with two pairs of coupled wheels, the "ten-wheeled" or 4–6–0 type was usually employed. With the introduction of the "Atlantic" (4–4–2) type in 1895, the capacity of the four-coupled locomotive was materially increased, due to the application of a large boiler with a deep, wide firebox. The use of trailing wheels made this construction possible. The installing of heavier tracks and bridges on many roads also permitted an increase in axle loads, and hence it was practicable, to a large extent, to replace "ten-wheeled" (4–6–0) type locomotives with engines of the "Atlantic" type, with most satisfactory results. As trains continued to increase in weight, four coupled locomotives again became inadequate; and the "Pacific" (4–6–2) type, with a wide firebox boiler, was developed. At the present time, the greater part of the fast passenger traffic in the United States is being worked by locomotives of this pattern. The building of "Atlantic" type locomotives has almost ceased, except in the case of the Pennsylvania Railroad, which has recently constructed a large number of them at its shops at Altoona, Pa. These locomotives carry unusually high axle loads, and are successfully handling heavy express traffic on the level portions of the system.

Locomotives of the "American" (4–4–0) type, are now practically confined to light service, and very few engines of this pattern are being built. For this reason the locomotive for the Philadelphia and Reading Railway (illustrated above), which is one of ten constructed in 1914, is of unusual interest. These locomotives, like the others described in the present article, were built by The Baldwin Locomotive Works. The Philadelphia and Reading handles a large amount of local and suburban traffic, and also of express traffic on comparatively short divisions, where train loads are not excessive but schedules are most exacting; and a large part of this service is handled

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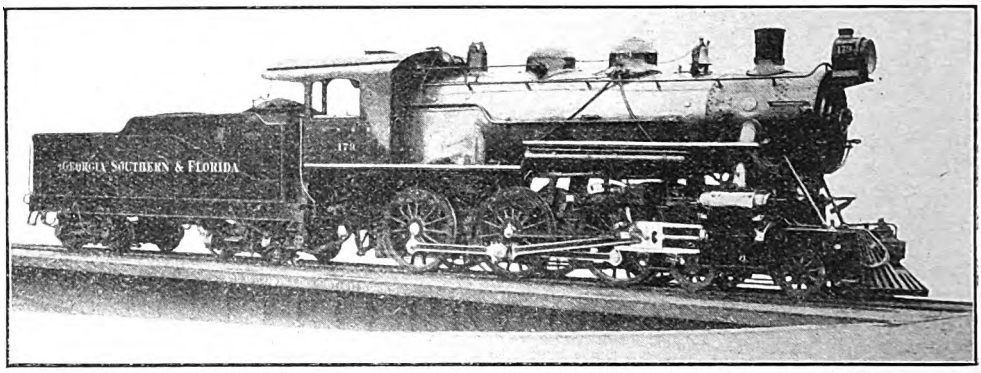
by "American" type locomotives. The present engines use superheated steam, and represent the latest development of an interesting series which have been constructed for this road.

These locomotives have boilers of the Wootten type, and burn a mixture of small-sized anthracite and bituminous coal. The grate has a width of 108¼ in., and the furnace is built with a combustion chamber 33 in. long, which extends forward into the boiler barrel. A brick wall is built across the throat of the combustion chamber. The tubes are unusually short, having a length of only 10 ft. 5 in. The superheater is of the Schmidt type; a design that is now being used, in American locomotives, to the practical exclusion of all others.

Careful attention has been given to the design of the machinery and running gear of these locomotives, in order to cut out superfluous weight where possible. The valve motion details are of open-hearth, oil-treated steel, and are as light as is consistent with the required strength. The piston-rods and crank-pins are of "Nikrome" steel, the latter being hollow bored; while the driving-axles, which are of open-hearth, forged steel, are also hollow bored. The Ragonnet power reverse gear is applied, and the mechanism is supported on the right-hand side of the boiler, forward of the firebox. This is a particularly convenient arrangement in the case of the present engines, as it would be difficult, on account of the exceptionally wide firebox, to instal a reverse lever of the usual type.

The "ten-wheeled" locomotive for the Georgia, Southern and Florida Railway, illustrated above, is one of six which were built for this road in 1914. This engine burns bituminous coal, and has a wagon-top boiler with a wide firebox. The grate is placed above the rear pair of driving wheels, and is sloped toward the front, in order to provide a sufficiently deep throat. A superheater is applied, and steam is distributed by 12-inch piston valves which are driven by the "Southern" valve motion. This gear is being given extensive trials, notably on the Southern Railway, and its affiliated lines. The valve is driven from one arm of a bell-crank, the other arm of which has a vertical connection with the forward end of the eccentric rod. This rod derives its motion from a return crank on the main pin, and is suspended, near its forward end, from a block which is arranged to slide in a link-shaped guide. The direction in which the locomotive will run, as well as the point of cut-off, is determined by the position of the block in the guide. This gear is notable because of its simplicity and the few points of wear; also because it is driven from one point only, there being no cross-head connection such as is commonly found in outside valve gears. The frames of this locomotive are of vanadium cast steel. Frames of this material have been used in a large number of heavy engines built during the past few years, with satisfactory results.



"TEN-WHEELED" LOCOMOTIVE: GEORGIA, SOUTHERN AND FLORIDA RAILWAY.
Built by The Baldwin Locomotive Works.

The "ten-wheeled" type is handicapped by reason of limited steaming capacity in proportion to adhesion, and also because, if the driving wheels are of large diameter, and a wide firebox is applied, the furnace throat is necessarily shallow. For this reason, where locomotives of high power are required, the "Pacific" (4–6–2) type is generally used in preference to the "ten-wheeled." The locomotive for the New Orleans and North Eastern Railway, shown

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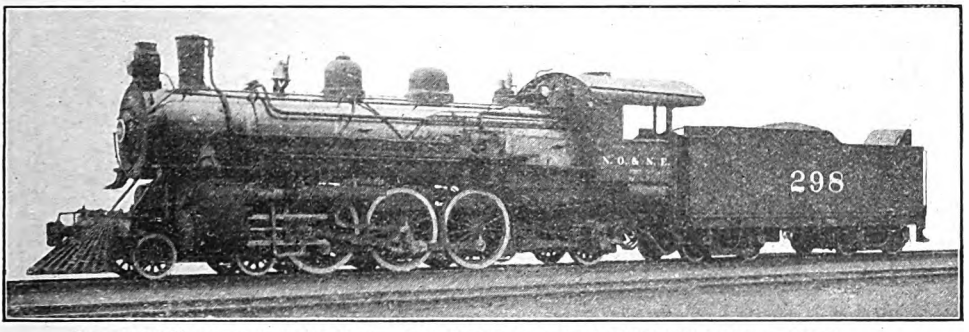
on this page, is a "Pacific" type of moderate weight, designed to operate on rails weighing 75 lbs. per yard. The wheel loads are necessarily limited, and the locomotive carries less weight on the driving wheels than does the "ten-wheeled" engine for the Georgia, Southern and Florida Railway, but its total weight is slightly greater, and the boiler contains a larger amount of heating surface. The locomotive is cylindered up to the limit of its adhesion, as the tractive force developed is 33,800 lbs. with 130,500 lbs. on driving wheels. The usual practice with superheater locomotives in the United States is to use large cylinders and a relatively low ratio of adhesion. The temperature of the steam is sufficient to eliminate condensation, even with a large external cylinder surface; and high tractive forces can be developed while working the steam expansively.

axles, and connecting and coupling rods, of the "Pacific" type locomotives, are of vanadium steel.

The locomotive for the Carolina, Clinchfield and Ohio Railway (page 420) is one of two which were specifically designed for service in a mountainous country. The Clinchfield is a new line, which traverses valuable coalfields in the Blue Ridge. Although the avoidance of steep grades was kept constantly in view during its construction, it is far from level. There are numerous grades averaging from 1 in 200 to 1 in 125, and one hard stretch, 20 miles in length, with a practically unbroken grade of 1 in 85. On a line of this character, the passenger locomotives must have capacity to maintain a high draw-bar pull for sustained periods, rather than the ability to run at unusually high speeds. This requires sufficient starting tractive force, backed by



"PACIFIC" TYPE LOCOMOTIVE: NEW ORLEANS AND NORTH EASTERN RAILWAY.
Built by The Baldwin Locomotive Works.

The locomotive for the New Orleans and North Eastern is equipped with the Gaines locomotive furnace. The front portion of the firebox is used as a combustion chamber, and is separated from the main portion by a transverse brick-wall. Pre-heated air is admitted at the top of the wall, immediately under a brick-arch which is supported on water-tubes. This provides a long flame-way, with an unusual amount of space for the combustion of the gases.

These "Pacific" type locomotives were built contemporaneously with a number of "Mikado" (2–8–2) type engines for the same road; and a large number of parts, including boilers and accessories, cylinders, driving-boxes, back engine trucks, and various machinery details, are inter-changeable in the two classes. This is an important advantage from a maintenance standpoint. The frames, driving-axles, engine truck

ample boiler power to maintain full steam pressure when working with a relatively long cut-off at moderate speeds.

In this design superheated steam is used, and a tractive force of 46,000 lbs. is developed with a ratio of adhesion of 3·85. The weight on the driving wheels is, therefore, utilised to the fullest extent. The boiler is of the wagon-top type, with a maximum diameter, at the dome course, of 85⅞ in. The furnace equipment includes a brick-arch, steam grate shaker and pneumatically-operated fire-door; while provision has been made for the subsequent application of a Hanna mechanical stoker, should this be found necessary.

Engine springs and frames used in this locomotive are of steel with vanadium content, while the driving-tires, driving-axles, and crank-pins, are of chrome vanadium steel. The frames are 5 in. wide, and

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a very thorough system of transverse frame bracing is applied. The rear truck is of the Hodges radial pattern, with long half-elliptic springs placed directly over the boxes. The spring hangers are jointed to take the side swing. As is usual in this type of locomotive, the rear truck springs and driving springs are connected by equalising gear.

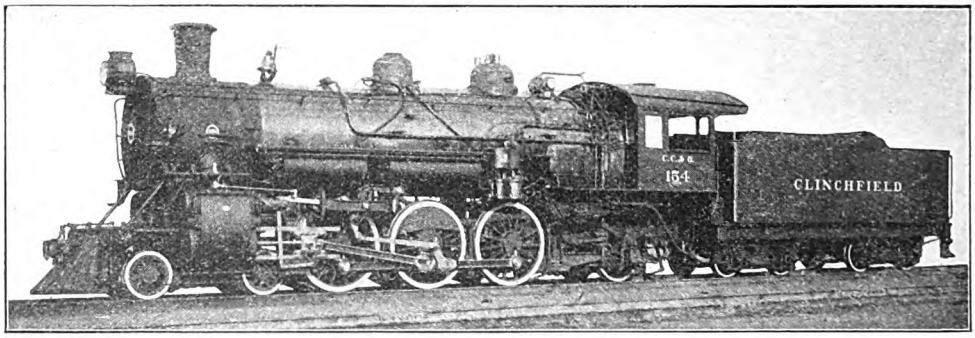
The locomotive for the Atchison, Topeka and Santa Fe Railway, illustrated on page 421, forms part of the Baldwin exhibit at the Panama-Pacific International Exposition. In its general proportions, this locomotive presents a strong contrast to the Clinchfield engine previously described. It is more suitable for high speed service, having larger driving wheels and higher boiler-power. The total weight is somewhat greater, while the starting tractive force is less (41,000 pounds) with a ratio of adhesion of 4·2. The locomotive was designed to develop maximum capacity with a limiting rail-load of 58,000 lbs. per pair of driving wheels, and the total adhesion weight of 172,500 lbs. closely approaches this limit.

This locomotive is intended for service on the Pacific Coast lines of the Santa Fe system, and is equipped for oil-burning; but is so designed that it can, if necessary, be subsequently changed to a coal-burner. The boiler has a maximum diameter of 90 in., and the superheater is unusually large for a "Pacific" type engine. It consists of 40 elements, and has a superheating surface of 980 sq. ft.

Cylinder diameter and piston stroke are each 26 in., and the piston valves are of large diameter (16 in.), set to cut off at 87 per cent. of the stroke in full gear. The Baker valve motion is applied. This is a pin-connected gear, without links or sliding blocks, but deriving its movement from the main-pin and cross-head, as in the Walschaerts motion. The Ragonnet power reverse mechanism is applied.

A Rushton trailer truck with outside journals, as applied to a large number of Santa Fe locomotives, is used on this engine. The truck frame is composed of steel castings, and the yokes which carry the truck springs are hung on three-point suspension links. This construction tends to hold the truck frame central, thus preventing vibration and unsteady riding.

Tender trucks are of interesting design, as they have six wheels each. This reduces the journal and wheel loads, which are necessarily high in large tenders having four-wheeled trucks. In the present instance, the tender is unusually large, having capacity for 10,000 gallons of water and 3,300 gallons of oil.



"PACIFIC" TYPE LOCOMOTIVE: CAROLINA, CLINCHFIELD AND OHIO RAILWAY.
Built by The Baldwin Locomotive Works.

The locomotive for the Chicago, Burlington and Quincy Railroad (page 421) is one of fifteen built during the present year. The requirements in this case called for "Pacific" type locomotives of maximum capacity, carrying approximately 170,000 lbs. on driving wheels, with a limit of 60,000 lbs. on any one pair. It was also specified that the excess pressure on the rail, due to the action of the counter-balance, should be kept as low as possible. This has been accomplished by careful designing and the use of special materials for the reciprocating parts.

A wagon-top boiler is employed, with a wide firebox and combustion chamber. The latter extends forward into the boiler barrel, and materially increases the furnace volume. The tubes are shorter than they would be if no combustion chamber were used, and the heating surface is consequently reduced;

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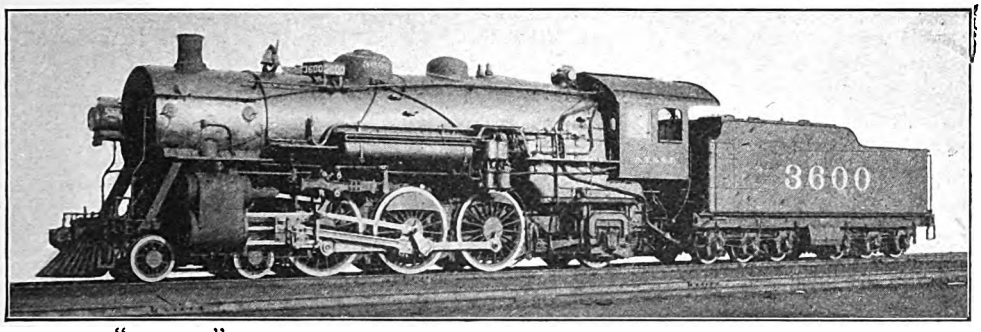


"PACIFIC" TYPE LOCOMOTIVE: ATCHISON, TOPEKA AND SANTA FE RAILWAY.
Built by The Baldwin Locomotive Works.

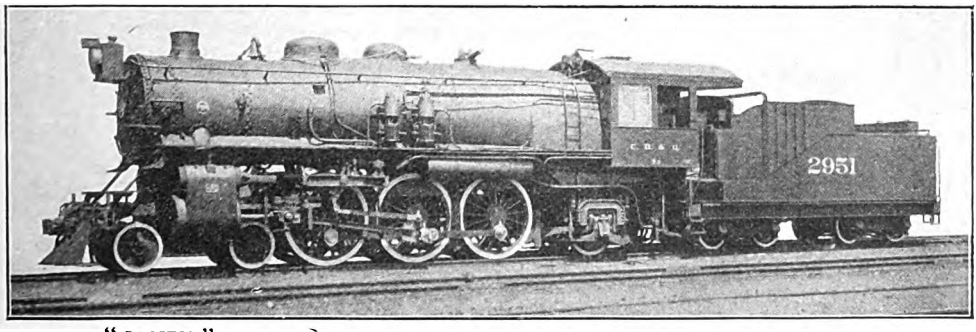
but full compensation is made for this loss by the increased combustion space. Due attention has been given to the water circulation in the boiler, and the tubes have not been crowded in order to gain heating surface. The furnace equipment includes a brick-arch; and the railroad company's standard design of smoke consumer is applied, with four air inlet tubes on each side of the firebox.

As previously mentioned, special consideration has been given to the design of the machinery and reciprocating parts. The pistons have a dished section, and are of annealed cast steel with ·40 per cent. carbon content. They have iron bearing rings cast on them. The piston rods are of "Nikrome" steel, hollow bored, and forced into the pistons under a pressure of 35 tons. Each piston and rod complete, with cross-head key, weighs 557 lbs. The cross-heads weigh 414 lbs. apiece; they are of the Laird type, with annealed steel bodies and bronze gibs. The cross-head pins and crank-pins are of "Nikrome" steel, hollow bored; and the same material is used for the connecting rods, coupling rods, and coupling rod knuckle-pins.

The proportion of the reciprocating weight which is balanced, is 61 per cent.; and the excess pressure on the rail, at a speed of 70 miles per hour, amounts to approximately 38 per cent. of the static weight for the front and back driving wheels, and 28 per cent. for the main wheels. The locomotive is actually less destructive to the track than are many other engines which carry a lower static weight per pair of driving wheels.

Frames are of annealed cast steel, with 40 per cent. carbon content, and manufactured to specifications prepared by the American Society for Testing Materials. The trailing truck is of the Rushton pattern, and is practically a duplicate of the truck used on the Santa Fe locomotive previously described. The spring rigging of the truck is connected to the driving spring rigging through a vertical link placed on the centre line of the locomotive. This construction, while maintaining the desired weight distribution, prevents any rocking action from being transmitted from the driving springs to the truck springs, or *vice versa*. The locomotive should, therefore, prove a steady rider.

The tender is equipped with a coal-pusher; a power operated appliance, with which the coal can be mechanically moved



"PACIFIC" TYPE LOCOMOTIVE: CHICAGO, BURLINGTON AND QUINCY RAILROAD.
Built by The Baldwin Locomotive Works.

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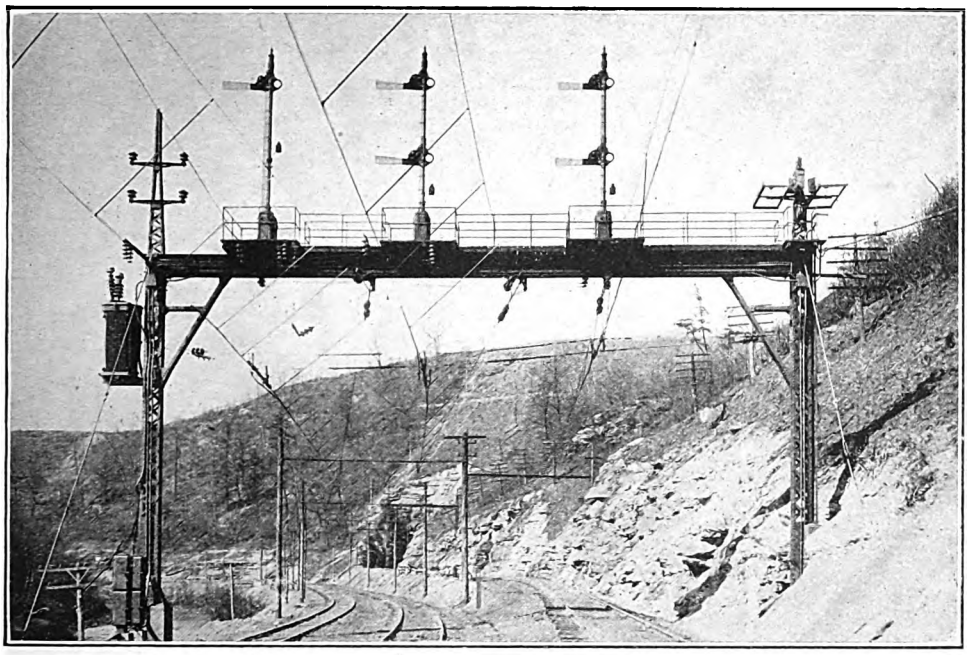

THREE-TRACK SIGNAL BRIDGE AT BLUESTONE JUNCTION.

Railway Electrical Progress and Practice.

TWO REMARKABLE AMERICAN RAILWAY ELECTRIFICATIONS. [No. II.].

By "INDICATOR."

CONTINUING reference to the Elkhorn grade electrification, Norfolk & Western Railway, the power station, of the usual type, using steam boilers and steam turbines as the prime movers, is located at Bluestone, on the Bluestone river, about 11 miles west of Bluefield, mainly for the reason that this is almost the only available source of water for boiler feed and condensing purposes in the district. The main structure is about 135 ft. by 158 ft., with a 52-ft. by 33-ft. extension at the north-east corner.

The main building contains a boiler room 79 ft. 3 in. by 158 ft. 6 in., and a turbine room 56 ft. by 158 ft. 6 in. Across the east end of the turbine room a section 26 ft. wide is assigned for switching equipment, offices and other facilities, and fitted with intermediate floors and galleries. On the second, or mezzanine, floor of this section are located the locker and toilet rooms for the engineers and firemen. Above this, on the main floor, is the low tension switching room, which is separated from the turbine room by heavy wire screens. The next floor is the operating gallery, overlooking the turbine room, and a small office and a lavatory. The top gallery is used for offices. On the ground floor of the extension building or transformer house are the step-up and step-down transformers, and on the second floor is located the high tension switching apparatus.

Boilers, stokers, stoker engines and feed-water heaters are located on the main floor of the boiler room, while the pumps, oil filters, air compressor, ash-handling equipment, and the forced draft fans are in the basement, the pumps and filters being in a separate room. The main material store room also occupies a separate room extending along one side of the basement. The main turbo-generator units, exciters and signal

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generators are located on the main floor of the turbine room, the condenser equipment and fans for cooling the generators being in the basement. The turbine room is spanned by a 30-ton travelling crane. The basement floors are at the ground level, while the turbine room floor is 18 ft., and boiler room 13 ft. 6 in. above.

The main turbo-generators are of the Westinghouse type, having a rating of 10,000 k.w. at 80 per cent. power factor, 11,000 volts, 25 cycles, single-phase. At this rating, the generators are specified to operate for 24 hours with a rise in temperature not exceeding 60 deg. C. above the temperature of the cooling air. They are capable of delivering a single-phase output of 12,500 k.w. at 80 per cent. power factor for 5 min. without injurious heating. The field coils are of the two-pole type, wound with copper strap and insulated for a one-minute potential of 1,000 v., a.c. The armatures are wound for three-phase power, and are insulated for a one-minute voltage test of 22,000 volts, and the insulation is capable of withstanding a temperature of 90 deg. C. without injury. Each generator is ventilated by a No. 6 Sirocco blower, having a capacity of 50,000 cub. ft. of air per minute.

There are two turbine-driven and one motor-driven exciter generators. The turbo-driven sets consist of small Westinghouse horizontal turbines rated at 150 k.w. The generators are compound wound machines of the rotary armature type, with commutating poles, and have a rating of 600 amperes at 250 volts when running at 2,200 r.p.m. The motor-driven set consists of a three-phase induction motor rated at 150 k.w. at 440 volts, 25 cycles, running at 720 r.p.m. The generator is a compound wound machine of the 6-pole type with a normal rating of 600 amperes at 250 volts. The motor takes power from a three-phase self-cooled oil transformer rated at 200 k.v.a. A Tirrill regulator is used to vary the exciter voltage and current over sufficient range to insure practically constant voltage on all three main generators under all operating conditions.

Power for signal service in the electrified zone is supplied by two turbine-driven generators. Each set consists of a horizontal Westinghouse steam turbine direct connected to a 50 k.w., 4,400 volt, 60 cycle single-phase generator.

Traffic on the electrified section is handled by twelve 270-ton Baldwin-Westinghouse locomotives, each consisting of two 135-ton units or halves. It is necessary in handling heavy trains on mountain grades to have a part of the motive power at the rear of the train. In this case the power is divided equally between the two ends of the train, and the trains are of such length in this mountainous country that there is difficulty of transmitting the starting and stopping signals from one locomotive to the other, and thus the locomotives are subject to treatment such as is unknown in ordinary traffic. This would require very careful handling with the ordinary locomotive, but these locomotives are designed to meet these severe requirements of the service without involving special manipulation.

These locomotives, of Baldwin-Westinghouse construction, each consist of two 135-ton units or halves, so that the total locomotive weight is 270 tons. The conditions of traffic are, however, so arduous and exceptional that the design necessarily includes many special features. The train weights are so great that it is necessary to have part of the motive power at the rear in order to avoid excessive strain, while the length of trains involves a difficulty in signalling from the locomotive at the head of the train to the one at the rear, so that the engines are subjected to treatment which in ordinary service would be considered impossible. For example, it is not unusual for the rear locomotive to receive a signal to start a minute or even more before the head locomotive has been put into action. In consequence, the rear locomotive stands still during this period, notwithstanding that it is exerting its full tractive effort. This condition arises most frequently when the rail is wet or when the air brakes do not release promptly. Under such circumstances the train must frequently be allowed to drop back a little, and the attempt to start it must be repeated. Moreover, when a train on an up gradient comes to a stop the leading driver may shut off power and apply the brakes, whilst the rear engine keeps pushing the train until its tractive effort is exceeded by the front trucks being pushed together.

The rigid construction of the three-phase induction motor and its freedom from commutator troubles are of the greatest importance in meeting these conditions. The liquid rheostat used, moreover, gives the smoothest possible graduation of tractive effort, and the latent heat of the steam that is generated therein makes possible the

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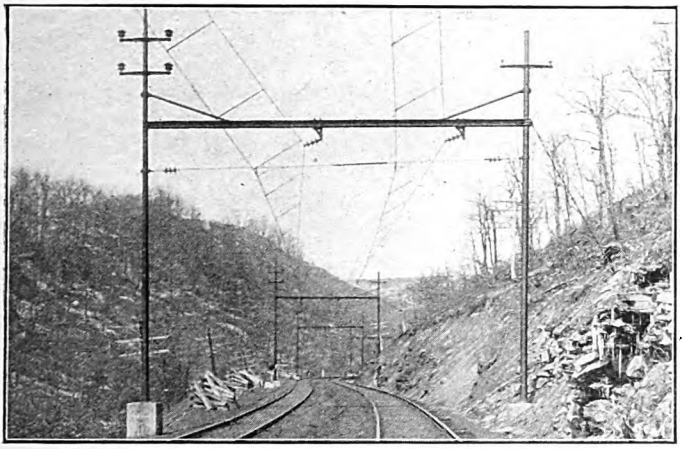


A VIEW ON THE LINE SHOWING CATENARY SUSPENSION OF CONDUCTORS.

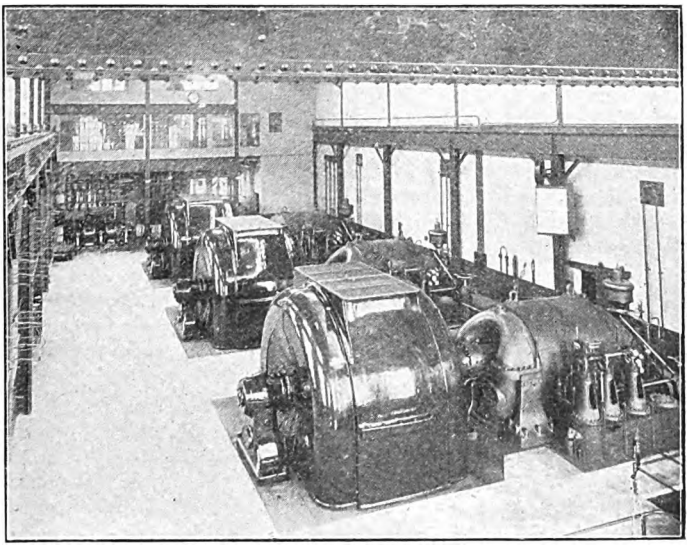
running at 14 miles per hour, all the motors are connected in parallel and the eight-pole stator windings are brought into use. When running at 28 miles per hour the motors are also connected in parallel, but they then work with four poles, and the speed is consequently doubled.

The two units which constitute the locomotive can be operated by the control gear at either end of the engine. The 11,000-volt current collected from the line is fed through an oil-type circuit breaker to the main transformer, and the phase converter, which changes the single-phase current into polyphase current, is connected to the secondary of this transformer.

On the roof of each locomotive two pantagraph current collectors are fixed, and they are arranged to be fitted, if necessary, with end horns which will automatically fold in when the pantagraph is lowered by the tunnel trolley wire, and in this way the wide sliding surface will accommodate itself to the restricted tunnel clearances. There are four liquid resistances, one for each motor. They are operated in pairs, each pair having in common one storage reservoir and cooling tower, one circulating pump, and one operating mechanism. There is also a motor-driven centrifugal circulating pump, which circulates the liquid to prevent excessive heating.

The electrified section of the railway was formerly equipped with automatic signals of the direct current type requiring primary storage batteries, these signals being usually mounted on posts along the track. Under electric operation, however, it was deemed advisable to make use of these signals, which were only recently installed and practically new, on other parts of the railway, and to provide new alternating current signals in connection with alternating current track circuits, the signals being mounted on the catenary bridges. There are 70 automatic signals, two electro-mechanical plants having two 3-arm, ten 2-arm, one 1-arm and six dwarf signals and an electro-pneumatic plant having one 3-arm, four 2-arm, six 1-arm and three dwarf signals.

Current for the signal system is generated by two 100-k.v.a., 4,400-volt, 60-cycle steam turbine sets located in the power house at Bluestone and is supplied directly to the signal transmission



INTERIOR OF THE POWER HOUSE.

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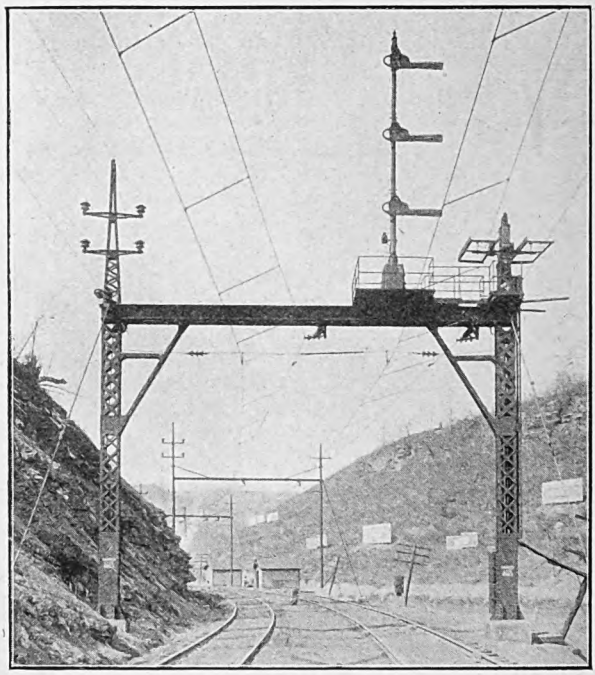

SIGNAL STRUCTURE ON TWO-TRACK SECTION.

line. These are duplicate sets, one being of sufficient capacity to carry the entire signal load and the other being held for emergencies. The switchboards for these sets are located in the main switchboard operating room, but the high tension switches are located in the switching room below and operated from it by mechanical connections.

Double rail track circuits are used throughout. The average block is 4,500 ft., the maximum 5,800 ft., while circuits in interlocking limits are sometimes as short as 300 ft. The track circuits are supplied by 200-volt, air-cooled transformers having primary coil wires for 110-volts and secondary coil with taps for 3, 6, 9, 12, 15 and 18 volts. In three cases where track circuits are very long and track conditions bad, a 1-k.v.a. transformer is used, supplied from the 110-volt taps of the signal transformer. The track relays are of the centrifugal, two-element type.

The track transformer, track relay, reactance coil and line relays are housed in a cast iron relay box at concrete foundations at the base of the bridge on which the signal is located.

The signals are the Union Switch & Signal Company's style "S" three-position, upper quadrant operated by induction motors. They are mounted on the top of structural bridges on a platform. This platform extends to the north side of the bridge in all cases, so that persons on the platform will not be brought near the 44,000-volt feeders. Screens are placed underneath the 4,400-volt signal wires, so that persons on the bridge cannot come in contact with them. A hand railing extends all the way around the platform and access is had by a ladder on the end of the bridge. The signal transformer, cut-out boxes and lightning arresters are mounted on the bonnet pole carrying the signal transmission wires. The signals are equipped with enamelled steel blades and spheroidal lens lamps. They are lighted by 10-watt, 110-volt tungsten lamps. Two bulbs are provided in each lamp, one burning at a time, with a relay to automatically cut the second in, in case of a failure of the first.

The electro-mechanical interlocking at Graham has 14 working and two spare mechanical levers and six electric levers; that at Bluestone Junction 22 working levers and two spare mechanical levers and 14 electric levers. All control circuits and indicators at these plants are direct current operated by a battery of five batteries which are charged through a mercury arc rectifier from the signal transmission line. The electro-pneumatic interlocking plant at Elkhorn tunnel, which operates the switches on both sides of the tunnel, has a 17-lever machine with 13 working levers, which, besides the signals previously mentioned, operates eight switches and five derails. Two air compressors are used to supply the air for the plant at the tunnel, and two compressors are installed at a crossover 5,500 ft. west of the tower. Current for operating the air compressors is taken from the signal transmission line.

The writer is indebted to Messrs. Gibbs & Hill, Consulting Engineers, New York, for information and illustrations utilised for the preparation of this article, as far as the Norfolk and Western installation is concerned.

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Railway Signalling and Interlocking.

By T. S. LASCELLES.

IT is proposed in these articles to give some account of the principles and operation of the more generally used appliances employed in British railway signalling, and to set forth the fundamental principles of interlocking, which plays so important a part in the safe working of railways. Into the history of the subject it is not intended to go, but only to consider the general practice of the present day.

The importance of signalling in railway operating need not be emphasised. It has grown along contemporaneously with the development of traffic and with the speed and weight of trains, and it is taking its place as a recognised and respected branch of the Engineer's department side by side with the telegraph and other already well-established sections of administration. It will be convenient, first, to consider the various apparatus and devices used in an ordinary signal installation, in reference to typical small layout of signals, boxes, etc.

Fig. 1 shows a typical main line signal. The arm (of wood or corrugated steel) moves around a spindle and carries a "spectacle" in which red and green glasses are fixed before a lamp (or other colours in certain cases) to give the indications in darkness. The arm is counterweighted to remain in the horizontal or "danger" position, even with any snow accumulation on it, and has to be moved to the clear position by power of some kind. In mechanical signalling (alone considered here) this lever is moved through the agency of a wire extending to the lever in the signal cabin. The movement of this lever being transmitted to the arm itself by means of a rod or levers. The weight on the counterweighted lever serves to return the signal to danger by releasing the tension on the operating wire.

Usually the pivot of the arm is carried on the post itself, but on some railways—(Great Northern, Taff Vale, Barry, Lancashire, Derbyshire and East Coast (Great Central Railway), etc.) in this country, and in the Australasian Colonies, a different pattern of arm balanced in the centre—generally termed a "somersault" signal—is used. It is illustrated in Fig. 2, and it makes an exceedingly distinct signal. It was introduced by the Great Northern Railway after a disastrous collision at Abbots Ripton many years ago, caused through a signal sticking at "clear" from snow on the arm and spindle.

Signals almost always move downwards in England to indicate "Clear" but latterly the opposite course has been adopted on the Metropolitan and a few other lines. Fig. 3 indicates such a signal. The square end to the arm is employed for all signals except distant signals which are distinguished by having a V-notch in the end of the arm (fishtailing).

Before referring to special forms of semaphores used for special functions we may refer to ground shunting signals, usually of either the disc or dwarf semaphore type, the latter now superseding the disc. Fig. 4 shows a typical ground disc signal. It gives its indications by revolving and so presenting different coloured targets or lights to the engineman. Occasionally it may be seen mounted on posts, but this is not a general practice. It is only used for shunting movements at low speed and never for fast through traffic. The lights are small to avoid confusion with others, and in some cases do not show at all except when the signal is moved to give permission for the particular train movement it controls. Where there are objections to disc signals, "dwarf" semaphores (Fig. 5) are sometimes employed, and the practice of using the latter is extending. These are sometimes fitted with hinged or rubber arms, as they may be knocked against by shunters and others.

Reverting to the ordinary standard semaphore let us now consider its various uses, and variations incidental thereto as used for ordinary through or main line running. The appearance is as shown in the Fig. 1. The arm is painted red as seen from the front, white at the back, with a white or black sight mark (generally a bar) respectively.

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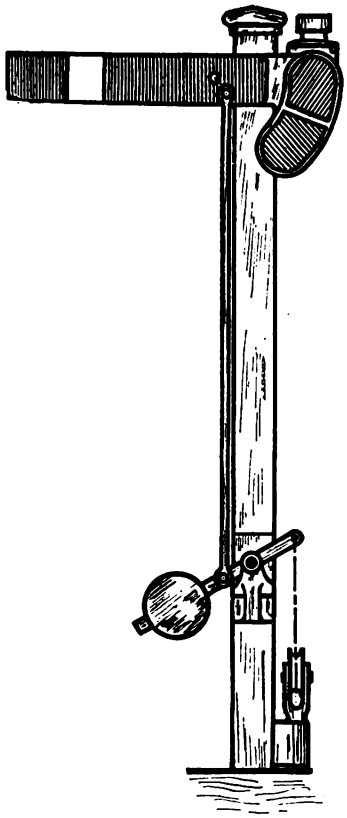

FIG. 1. MAIN LINE SEMAPHORE.

Reference to Fig. 6 will show various shapes of arms used for special purposes. Unfortunately, there is not uniformity amongst railway companies as to their uses. A shows a ringed arm variously used for siding signals or to distinguish slow line from fast line signals where "widened" lines exist. B indicates a form used on some lines for shunt-forward signals, C shows a peculiar arm having two holes in it used on the Great Western Railway for setting-back movements. D is the "scissor" arm. This is also variously used. On the London and South Western Railway it applies to shunt-back movements against the normal direction of traffic—"Wrong road shunt." Other lines use it for ordinary shunting movements or as a "calling-on" arm. In some cases where a loop line may be entered in the facing direction from the main line, such a movement is controlled by a dwarf arm set out from the post as indicated in E. F shows a much-used type of shunting forward or "calling-on" arm.

It is impossible to detail every type of arm and the practice of each railway. Almost every conceivable pattern of signal arm is in use for different purposes. It is necessary to mention the calling-on signal, however, not so much on account of its shape, as because of its methods of use and application.

A calling-on arm is a signal introduced to draw a train or engine forward into an occupied section of line when the ordinary through signal may not be cleared. It was first adopted to avoid the dangers attendant on hand or verbal signals that were at one time used for this purpose. It consists of a small arm fixed below the through arm as in Fig. 7. As a rule either the "calling-on" or the through arm is lowered, as circumstances may require. Some lines, however, use the indications A and C instead of A and B in the figure, and lower the "calling-on" arm or both arms. This seems rather an unnecessary proceeding, and one line, the writer believes, is now altering its practice to the first mentioned rule. Very often "calling-on" arms show a light only when cleared, there being no real necessity for one otherwise, seeing that the through arm is always above to give "danger."

In addition to informing the engineman

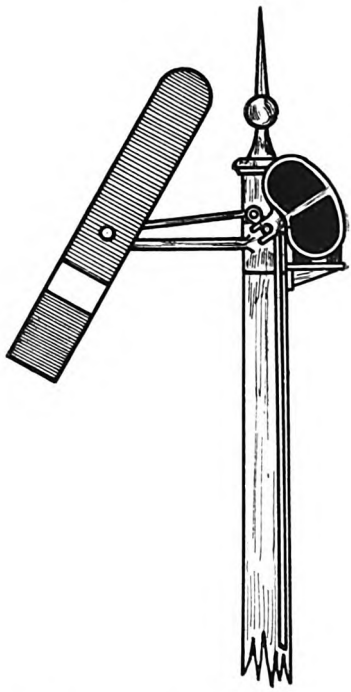

FIG. 2. "SOMERSAULT" SIGNAL.

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to stop or proceed it is also desirable to inform him which route he is being sent on where more than one is possible, as at junctions. The old and new method of doing this are illustrated in Fig. 8. The first consists in placing semaphores one above the other—one for each "route," the top arm referring to the most left-hand line to be reached, and so on. Besides being awkward to pick out any particular arm in this scheme when there are many routes, there is the further disadvantage that the lowest arm may refer to the most important and frequently used line, which is undesirable. Accordingly it is general to place the signals out on gantries or bridges, brackets, etc., so that they may be more readily picked out, besides conveying an indication of the lay-out. The relative importance of the routes concerned is indicated by the varying heights of the arms on the "dolls" (subsidiary posts). The distinction in height may be used to indicate the speed permissible. For example, where a junction is sharp or straight a considerable difference in height between the signals for the two routes would indicate the necessity for low speed on the diverging line. Where there are parallel lines of rails a distinction in height will also help to identify "which is which" among the signals.

Where there are many possible routes for a train, as where entering a terminal station, even this method becomes impossible owing to the numbers of arms required, and the difficulty of placing them, not to mention the trouble the enginemen experience in picking them out. It is then that "route-indicating" signals become useful. Fig. 9 is an example. One semaphore is provided, and below it a case is fixed the opening in which is normally blank or obscured. When the arm is lowered a number or other symbol is exhibited to indicate the route set up. Such signals are now being extensively adopted, and the multiplicity of signals formerly seen at some termini has been reduced.

A passing reference has already been made to the distant signal, and this will now be considered. It will be evident that an express train travelling at full speed would find it extremely awkward to come suddenly upon a signal demanding a dead stop within ordinary sighting distance, and that some notification of the necessity of stopping at a point where proper control of the train may be gained in time to do so, is essential for satisfactory working. This is the function of the distant signal. Fig. 10 illustrates the various circumstances that may affect it. At the top the simplest instance is shown. A distant signal standing alone and fixed a certain distance in the rear of the "stop" signal, as all square-ended arms are termed. The distance between the two signals will depend on several circumstances, but mainly on the gradient in ordinary cases, being longer on a down grade than on the level, and shorter on an up grade than on the level. When we come to consider interlocking we shall find that a "distant" cannot be lowered unless all the stop signals on the same route

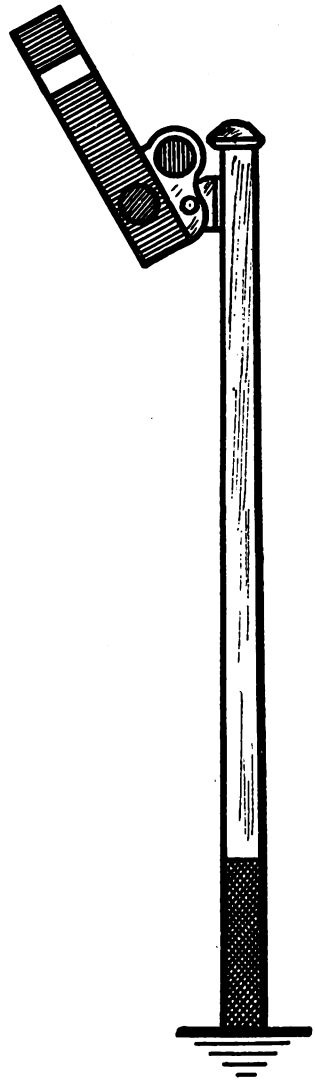

FIG. 3. UPPER-QUADRANT SIGNAL.

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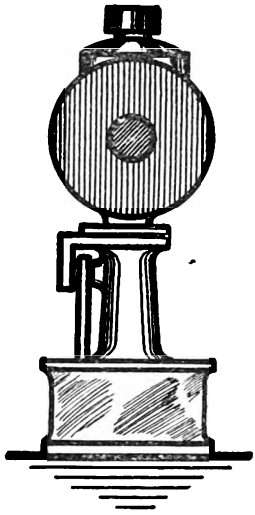

FIG. 4. GROUND DISC.

at the box from which the distant signal is worked are also lowered. It is thus a key to the situation, and a highly important signal for express trains.

It frequently happens that when a distant signal is its correct distance out it comes within the sphere of control of the adjacent signal box, in which case it may be placed under the final signal for that box, as in the second instance in Fig. 10. When this is done an appliance called a "slot" is used to control the distant arm and prevent it being lowered unless the upper arm is also lowered, or else contradictory signals would be exhibited. A slot may also be used in the case of a one arm signal so that the action of two men (or more if necessary) is necessary to lower the arm.

In Fig. 11 one way of doing this is shown, to show the principle. Each signalman operates a balance lever, and the levers are coupled to the signal through a cross bar having a pin on it adapted to move in a slot in the signal rod. The three moves shown in the Fig. indicate clearly what occurs, and it will be seen that both men must co-operate to lower the arm, but either can replace it to danger unaided.

There are other patterns of slot in use. One largely used consists in an extra opposing balance lever which falls and clears the signal when the controlling levers are all moved, being fitted with a cross-piece engaging with them and preventing movement until this is the case. The principle, or object, is similar in all slots.

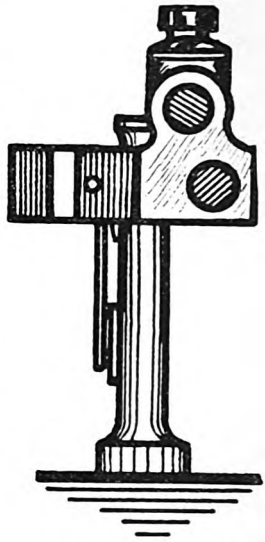

FIG. 5. DWARF SEMAPHORE.

Turning back to Fig. 10 we see in the third case another circumstance in which the distant signal may be placed. The final signal at the adjacent cabin may not be far enough back, and then the distant may be placed under a further signal to the rear. In this case a double slot is necessary as marked on the Figure. This is because the man working the distant signal may have reversed his lever but the rear man may wish to draw the train up from signal A to B. If arm B does not also slot the distant, when A is lowered the distant will also fall which would be very misleading to a driver,

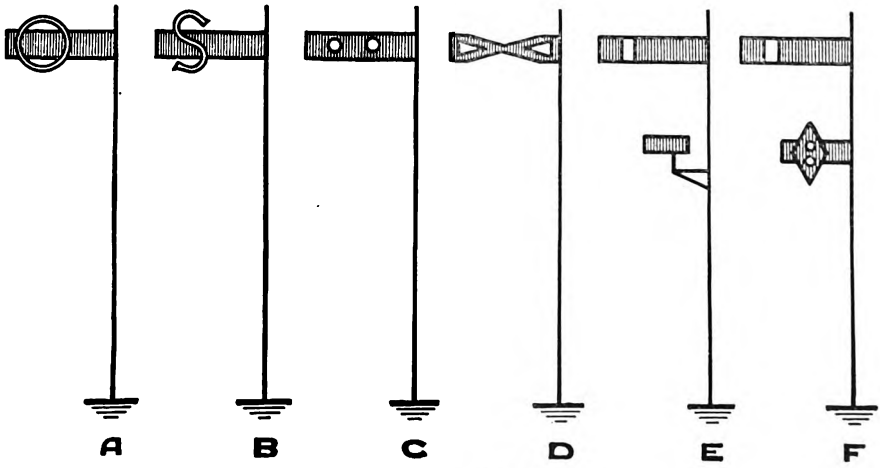

FIG. 6. TYPES OF SIGNAL ARMS.

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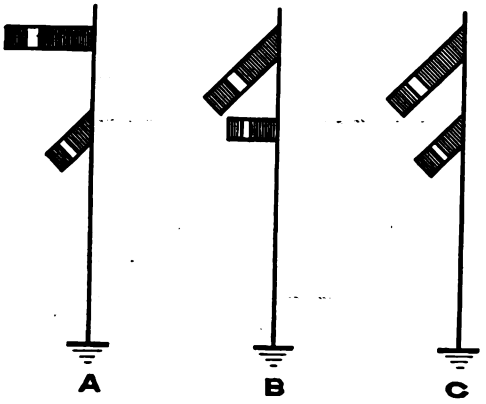

FIG. 7. OPERATION OF "CALLING-ON" ARM.

especially in bad weather, for after getting a clear distant signal he would encounter an adverse stop signal not relating to the next box. This double slot is also called a "back-slot."

It is very seldom that signals alone form the entire out-door gear of a signal box—points are almost always to be found. Points are invariably worked by rodding or pipe-lines in England, though wire-worked points are found in other countries. The rodding is carried by rollers placed at frequent intervals and is provided with screwed adjusting joints as required, being carried round corners, etc., by cranks of different patterns according to local circumstances. Points themselves may be either "facing" or "trailing" according to the habitual way trains run through them—whether they diverge or converge at that point. Trailing points are merely coupled to the rodding and are worked without any special apparatus, but facing points present dangerous features which have to be very carefully guarded against. If they should not be tightly home and securely fastened whilst a train is passing it might be "split" with disastrous results.

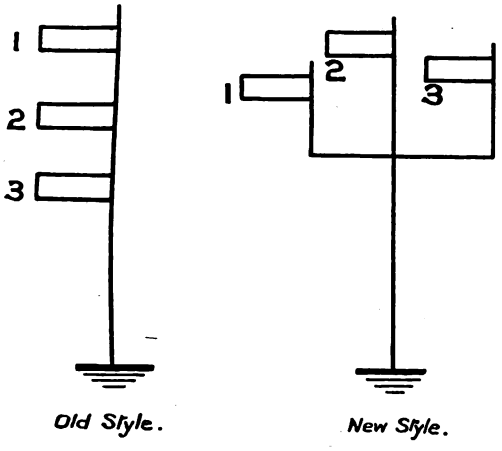

FIG. 8. MULTIPLE ARM "ROUTE INDICATING" SIGNALS.

Fig. 12 is a representation of a facing point lock and shows how safety is ensured. The tongues of the points are coupled in addition to the ordinary attachments, by a stretcher bar having in the centre a flattened portion punctured by two holes, into either one of which passes a plunger carried in a casting attached to the sleeper. This plunger is actuated from the locking bar which is in turn worked by a lever in the cabin. The

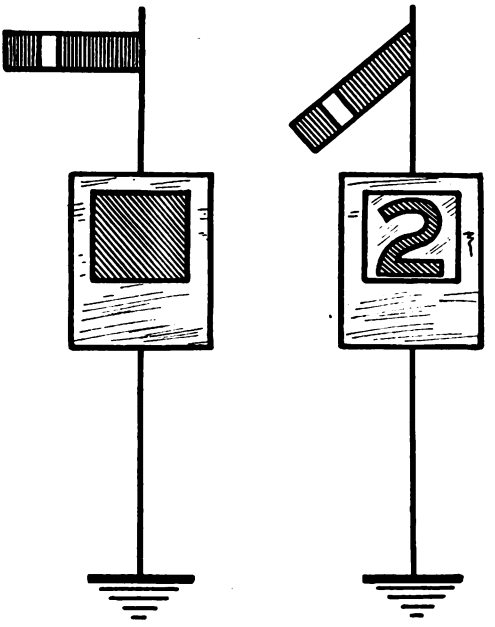

FIG. 9. SINGLE ARM "ROUTE INDICATING" SIGNAL.

locking bar consists of an angle or **T** iron carried on links and brackets by the rail, and it lies normally somewhat below rail level. When the lever working it is thrown it rises up above the level of the top of the rail and falls over on the other side of the centre. If a wheel should be on the bar it cannot be raised, and therefore the plunger cannot be withdrawn from the stretcher and so the points are held. By making the bar long enough to bridge the longest wheelbase it will prevent the points being unlocked during the passage of a train. There are slightly different arrangements of the gear in various patterns of facing point lock, but the object is in all cases the same.

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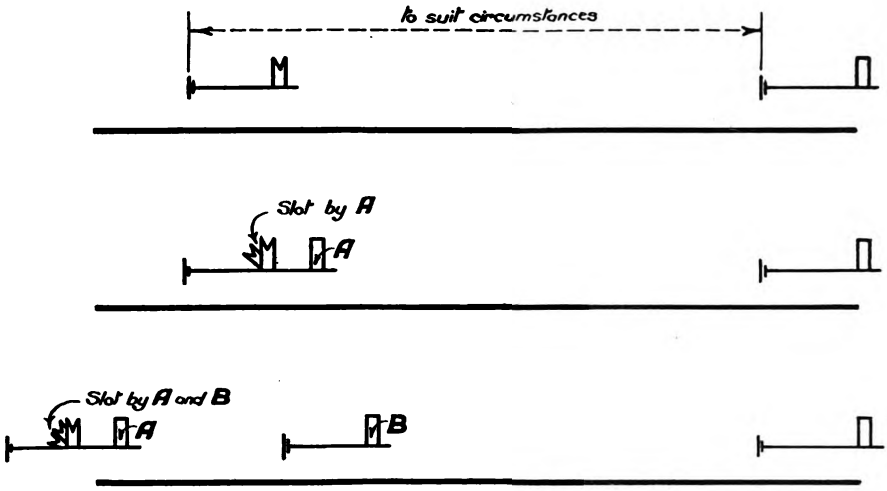

FIG. 10. DISTANT SIGNAL WORKING.

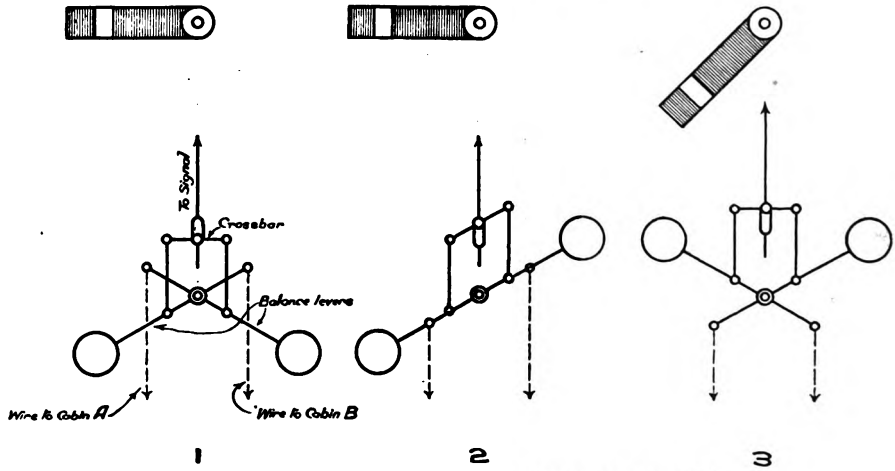

FIG. 11. DIAGRAM TO ILLUSTRATE ACTION OF "SLOT."

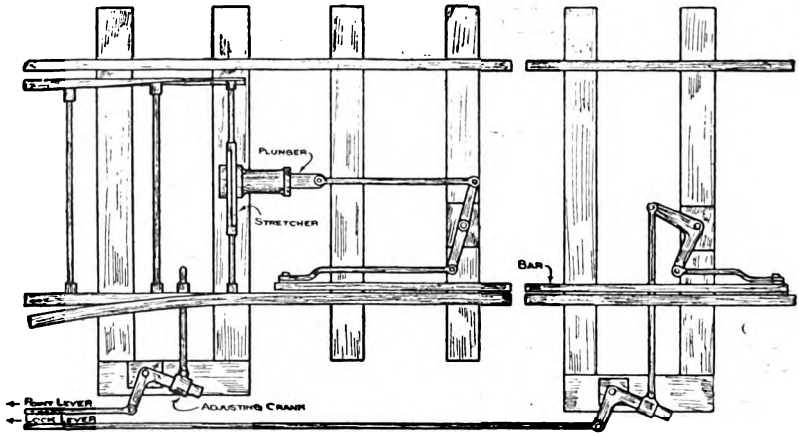

FIG. 12. FACING POINT LOCK.

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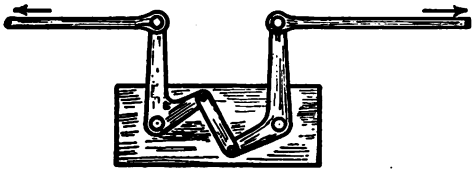

FIG. 13. POINT-ROD COMPENSATOR.

Sometimes the whole movement is effected by one lever, the plunger being withdrawn, the points moved and then replunged all by the one move through special mechanism. This is called an "Economical" or "Switch and Lock" movement.

It will be noted in Fig. 12 that adjusting cranks are used to transmit the motion of the rodding to the points or bar, so as to be able to obtain the correct move needed. Point rodding is, of course, affected by temperature changes and means have to be adopted to keep the relative length of the rodding the same under all conditions. The usual arrangement used is seen in Fig. 13 and is called the "lazy jack" compensator. It will be seen that it consists of an acute and obtuse crank coupled by a link and carried by a base plate, the point rodding being coupled to the cranks. Its effect is to reverse the movement of the rodding, and when placed midway in the length to be compensated it will take up the move, the ends of the rodding at the cabin and points being practically fixtures. Sometimes it is necessary to use more than one compensator where a long length has to be dealt with. Of course, anything which reverses the direction of the move, will act as compensator, and sometimes by a thoughtful arrangement of cranks, a compensator may be saved. Compensators may be fixed vertically or horizontally. One other arrangement of great importance in connection with the safe working of points is the Detector, illustrated in principle by Fig. 14. It will be evident that a point lever may be thrown

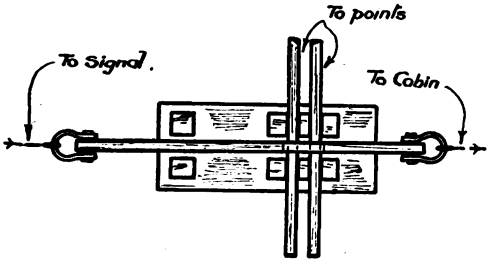

FIG. 14. DETECTOR.

and, owing to the rodding having fractured, the points fail to move also, and unless some means were adopted to prevent it an incorrect signal might be exhibited. This is prevented by the Detector. It consists essentially of a casting carrying a blade fixed in the run of the signal wire, whilst two blades, one attached to each tongue of the points intersect the first blade. By properly cut notches in the blades matters are so arranged that, unless the tongues of the points have both correctly moved in

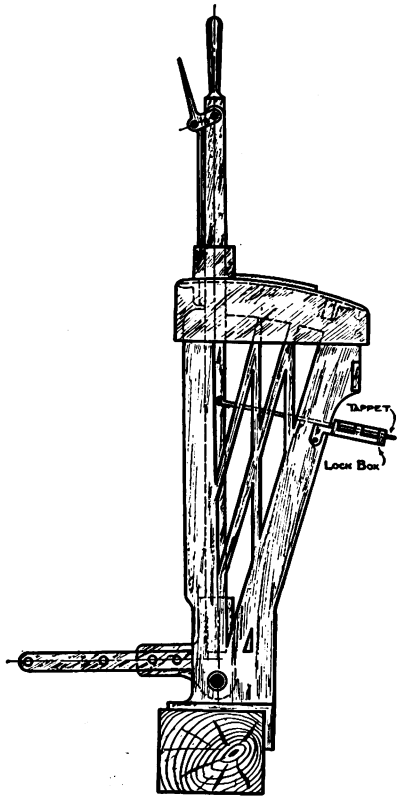

FIG. 15. STEVENS LOCKING FRAME, "LEVER LOCKING."

obedience to the lever, the signal wire cannot be moved, and therefore the signal cannot be lowered. Detectors are made up in several "ways" to accommodate one or more signals.

Outdoor signals, points and point locks, compensators, detectors, rodding and wiring practically make up the outdoor gear in a simple signalling scheme. We may now consider the operating mechanism in the cabin. The principal arrangement is the row of levers which, with their supporting

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gear and interlocking mechanism, make up the locking frame. The small differences of detail in shape of parts, size, etc., between different types of locking frame are not worth reference here. It is only in the actuation of the locking that a difference occurs which we must notice. Interlocking, or locking, has

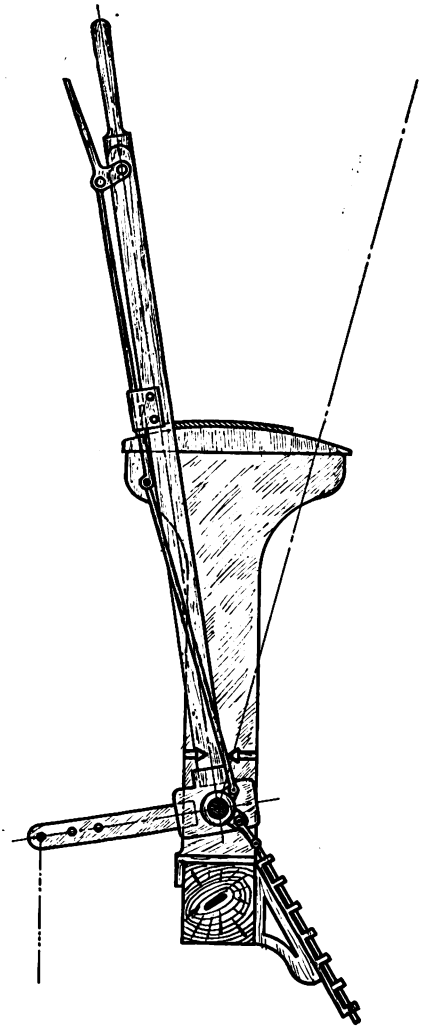

FIG. 16. EVANS & O'DONNELL'S "LATCH LOCKING" FRAME.

for its object to compel the signalman to make some lever movements in a predetermined sequence, and to prevent conflicting and dangerous movements being made at the same instant. How this is accomplished will shortly appear but we must note the two different principles used. One is known as "lever locking" and in this case it is the actual movement of the lever that actuates the locking gear. Fig. 15 is a sketch of an end-view of Stevens' frame which is of this description, the locking "tappet" being fastened to the lever direct.

The second principle is called "catch handle" or "latch" locking as it is actuated by the movement of the catch handle, or latch, which the signalman grasps before moving the lever. In Fig. 16 is seen Evans and O'Donnell's frame of this type. It will be noted that the locking tappet is coupled to a cam on the lever-shaft and this in turn is connected to the bottom of the latch-rod by a link. When the latch is lifted the tappet

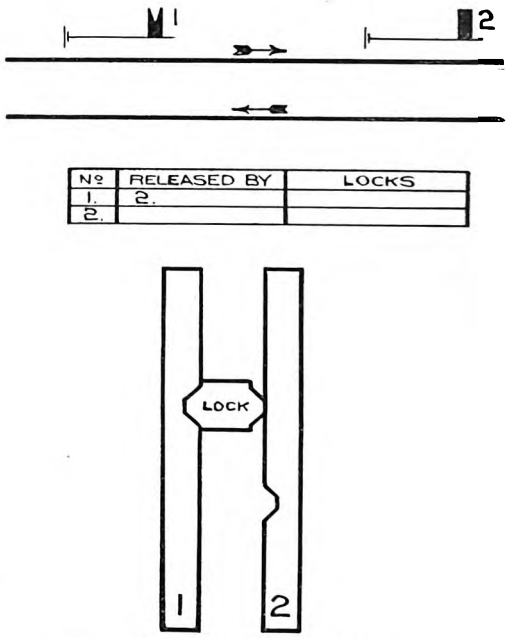

FIG. 17. "RELEASING" AND "BACK-LOCKING."

is moved and (by means soon to appear) the latches of conflicting levers are locked, while the lever is moving it brings the link over the centre against the reverse "stop" carried by the framing and so when the latch drops in the reverse position of the lever the tappet is moved a bit further in the same direction, so completing the locking.

In America it is compulsory to use latch-locking except for small frames in goods yards, etc., but in this country the two systems, "lever" and "latch" are fairly well balanced. Lever locking is held to be simpler, whilst the disciples of the latch system declare that the locking may be smaller, lighter and more compact, and

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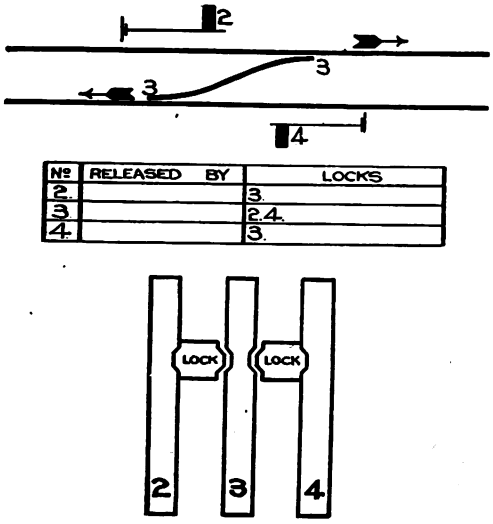
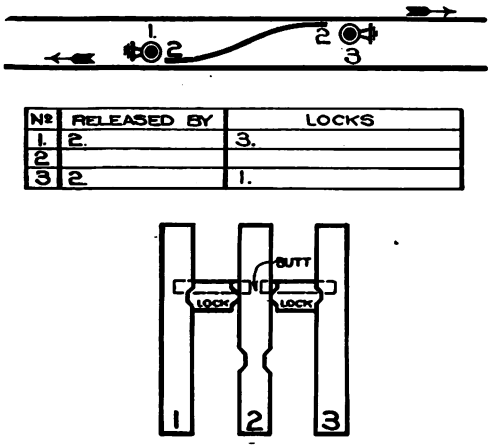


Nº	RELEASED BY	LOCKS
2.		3.
3.		2.4.
4.		3.

FIG. 18. "LOCKING."

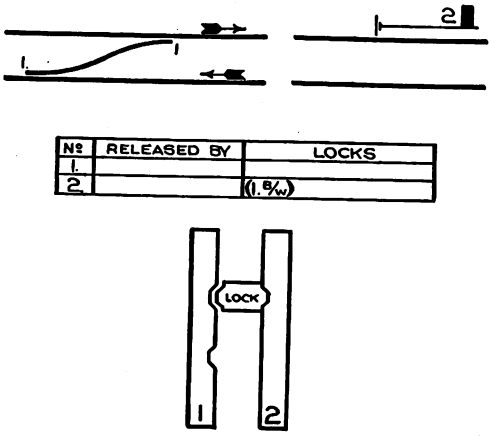
cannot be so easily strained. The writer prefers the latch system. The point rodding and signal wires are attached to the lever tails, being brought in from outside through the intermedium of cranks and pulley wheels, arrangements being made for adjustment of length, by turn-buckles, etc., at the lever-tails. We may now note the method now universally used for accomplishing the locking, releasing, etc, called the "tappet" system.

In Fig. 17 is shown a simple case of releasing a home and distant signal. A tappet is simply a steel blade working with the lever (or latch as maybe) and one is attached to each lever. (There may be more than one with "lever" locking in some



Nº	RELEASED BY	LOCKS
1.	2.	3.
2.		
3	2.	1.

FIG. 19. COMMON RELEASE AND OPPOSING LOCKS.

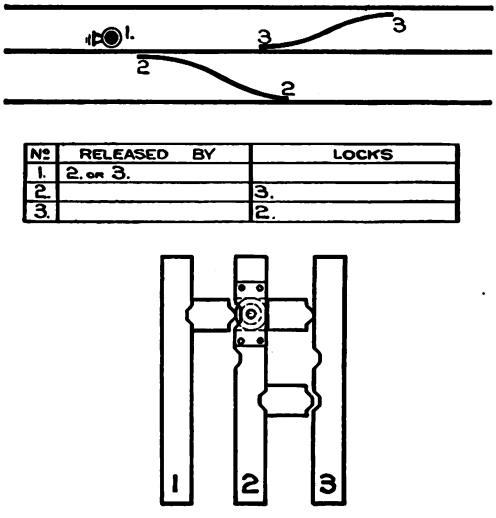


Nº	RELEASED BY	LOCKS
1.		
2.		(1.&/w)

FIG. 20. "BOTHWAYS LOCKING."

cases). Reference to Fig. 17 will show that until tappet 2 is moved to bring the notch opposite the lock (which moves transversely in a channel in the lock box) tappet 1 cannot move, hence lever 1 is released by lever 2 as shown in the locking-table in the Figure. When lever 1 is moved lever 2 will be locked, reversed, or be "back-locked" and lever 1 must be replaced first. Fig. 18 shows a case of locking between levers in the case of a cross-over line and the protecting stop signals. It is self-explanatory.

Fig. 19 is a very common piece of locking, used for signals leading in opposing directions through one connection. For this case the locking is effected by making the piece of rod attached to one lock "butt" the piece



Nº	RELEASED BY	LOCKS
1.	2. or 3.	
2.		3.
3.		2.

FIG. 21. "SPECIAL LOCKING."

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attached to the conflicting lock. "Butts" are very useful artifices in reducing the number of locks required, and a skilled locking designer will do a lot with them very often in a big signal frame. It will be understood that when levers are a distance apart the locks are coupled by rods to each other, the rods being carried by the lock box. Another element in locking is illustrated in Fig. 20. This is called "both-ways" locking. Lever 2 can be moved with lever 1 in either its normal or reversed position, but when moved it holds lever 1 wherever it may be till it is replaced. This is to hold the points whilst a train is going away past signal 2, whether the train has come straight along or over through the crossing.

In Fig. 21 is seen an instance of "special" interlocking—where one lever affects another or others in special circumstances only. The particular case shown in the Figure is very simple, but in large signalling installations very complicated cases of special locking are often met with. It will be easily seen from the figure how the ring in No. 2 tappet acts in pushing the lock that is released by tappet No. 3.

We have now noticed the elements of interlocking. A large signal frame is only a multiplication and combination of these elements in various degrees, but naturally, considerable skill and thought are required to lay out the interlocking for a frame of an size. In order to see how these elements are combined let us take the lay-out of lines and signals in Fig. 22 which shows a fairly typical arrangement of station signalling. No. 1 lever works the down distant signal, and it will be released by Nos. 2, 3, 4 being pulled. No. 2 is the down outer home signal. When this is lowered it must lock the conflicting points Nos. 7, 15, 18. No. 3, the down inner home signal will have to lock 15 and 18, and according to our Fig. 20 it must lock No. 7 both-ways (B/W). No. 4 must likewise lock Nos. 15 and 18 (B/W). We can see the use of the locking in Fig. 19 in the case of No. 15 crossing, Nos. 14 and 16 are released by No. 15 but lock each other. It will perhaps be best to give the locking table for this station, and the reader, by connecting it together with Figs. 17, 18, 19, 20 will be able to see the reason for it all himself.

In arranging interlocking the object to be aimed at is to secure the greatest safety consistent with freedom of traffic working. There are certain things which must be done, *e.g.*, a distant signal must be released

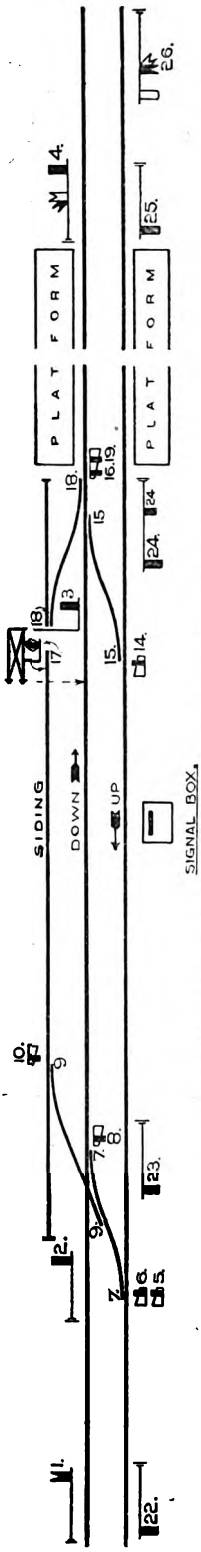

FIG. 22. TYPICAL ARRANGEMENT OF STATION SIGNALLING.

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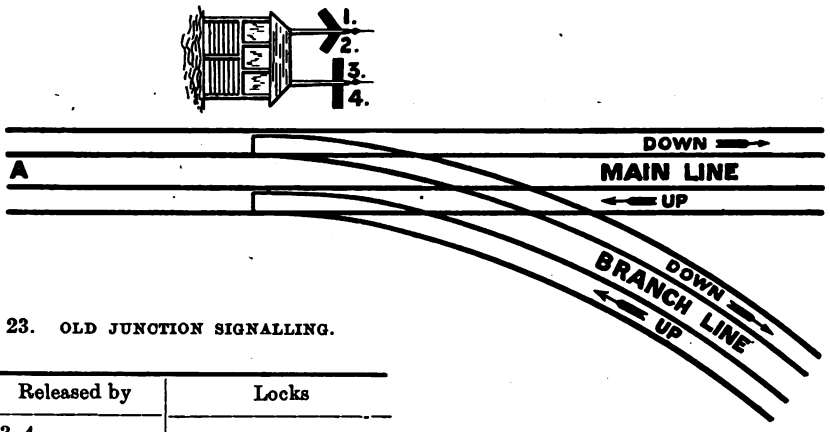

FIG. 23. OLD JUNCTION SIGNALLING.

No.	Released by	Locks
1	2, 3, 4	
2	.. .. ..	7, 15, 18
3	.. .. ..	8, 9, 15, 18, (7 B/W)
4	.. .. ..	16, 19, (15, 18 B/W)
5	7	8, 9, 22
6	9	10, 22
7	.. .. ..	2, 15, 18, 23, 24
8	7	3, 5, 9
9	7	5, 8
10	9	6
11	(Spare)	
12	(Spare)	
13	(Spare)	
14	15	16, 23
15	.. .. ..	2, 3, 7, 18, 24, 25
16	15	4, 14
17	18	19
18	.. .. ..	2, 3, 7, 15
19	18	4, 17
20	(Spare)	
21	(Spare)	
22	.. .. ..	5, 6, (7 B/W)
23	.. .. ..	7, 14, (15 B/W)
24	.. .. ..	7, 15
25	.. .. ..	15
26	22, 23, 24, 25 ..	

by all the others through signals in advance, conflicting signals and points must interlock. Conflicting points must do so as far as possible, whilst signals in advance must generally lock points in the rear both ways, but on these two last heads there may be certain variations needed to meet the circumstances of any one particular place.

In Fig. 23 may be seen a representation of the old fashioned way of arranging junction signals which, it will be noted, afforded no actual fouling protection, drivers being relied on to stop clear of other lines themselves. Nowadays the signals are placed at proper points to afford security to trains standing at them as shown in Fig. 24. The "clearance bars" shown (Nos. 6 and 11) are like the lock-bar of the facing-point lock and have to be thrown before the signal on the other line can be given, thus assuring that the tail of a train is clear. The junction points when arranged as shown must lock each other, otherwise an over-running down train might cut an up branch train in two.

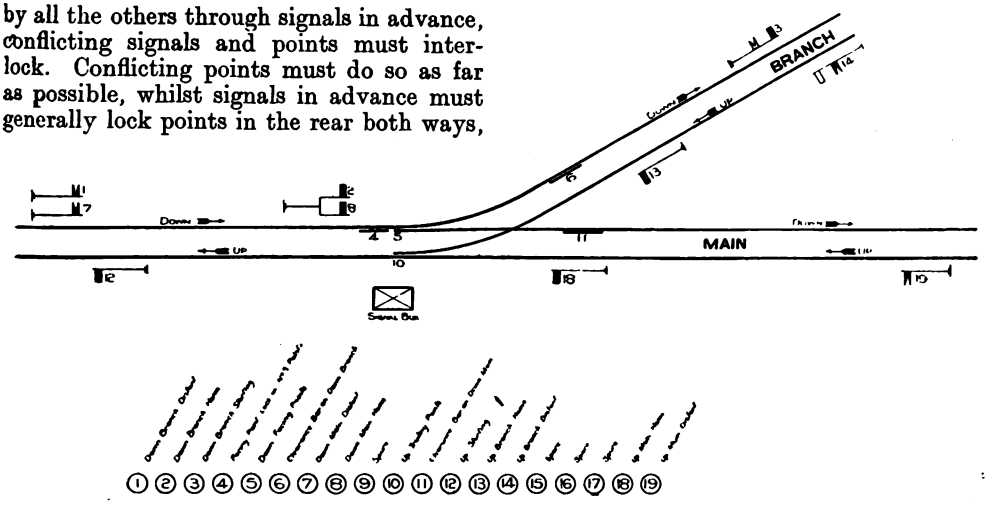

FIG. 24. MODERN JUNCTION SIGNALLING.

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Locomotive and Train Working in the latter part of the 19th Century.

GREAT WESTERN RAILWAY. [No. II.]

The Last Years of the Broad Gauge.

By E. L. AHRONS, M.I.Mech.E., M.I.Loco.E.

(*Continued from page* 364, *November* RAILWAY MAGAZINE.

IT may, perhaps, be natural to think that a considerable number of broad gauge engines would be stationed at Swindon. This, however, was not the case during the later years of the broad gauge, with which period I am dealing. This reminds me of an extremely "tall story" as related by a correspondent of one of the railway papers published about 1884-5, a periodical long since defunct. The correspondent wisely wrote under a *nom de plume*, and took part in an animated discussion on the respective merits of the engines and trains of the various railway companies, in the course of which he filled the *rôle* of an ultra-champion of the Great Western Railway broad gauge. According to his letter, this individual turned up suddenly and unannounced at Didcot station one morning, "wishing" (to use his own expression) "to catch the 'Galloper' (sic!) or 'Dutchman' at Swindon." He promptly ordered a "special," and "in two minutes I was served." The service consisted of an engine and coach, in which our friend travelled the 24¼ miles to Swindon in 18 min., and just caught the "Galloper"! This works out at nearly 81 miles per hour, start to stop, on a rising gradient. This statement held the floor; it was so baldly unblushing that it "staggered humanity," at least such portion of it as read the journal in question and took an interest in these matters. Nobody, as far as I remember, ventured to contradict it, for that would have involved politely referring to the correspondent as a story-teller, or words to that effect.

The fact is that for a long number of years—certainly at the period when the letter appeared—there had not been a broad gauge engine stationed at Didcot, even as pilot. If a broad gauge engine broke down between London and Swindon, which was a very rare occurrence indeed, the nearest narrow gauge goods engine was requisitioned and took the train gently in tow. It therefore followed that our friend's special must have been ordered by wire to come from Swindon to Didcot in less than 2 min. It would also have been "horsed" by one of the three ungainly 6 ft. coupled engines stationed at Swindon for piloting purposes, as these were the only engines available.

The three engines in question were the *Acheron*, *Phlegethon*, and *Hawk*, the *Hawk* being illustrated on page 441. These engines had 6 ft. coupled wheels, and 16 in. by 24 in. cylinders, and were known on the line as the "Avonside" class. The three engines in question were the last broad gauge coupled tender engines, other than the much later "Convertibles," to be built, and they came out from Swindon in 1865-6, having been constructed to the designs of Mr. Joseph Armstrong. There had been 26 of them, of which 20 were built by the Avonside Engine Co., of Bristol, Swindon being responsible for the other six. Of these, ten had been converted into 2-4-0 saddle tank engines with 5 ft. wheels, leaving 16 of the original tender engines at work. They were extremely ugly awkward looking engines, and the appearance of the *Phlegethon* was not improved owing to its old-fashioned "rolled top" chimney having a bit out of the top on one side, and a dent in the other. The *Acheron* was more presentable, as it had been fitted with one of Mr. Dean's standard chimneys. It is just within the bounds of possibility that 60 miles per hour might have been "pumped" out of them, but certain it is that no one of the three at Swindon could possibly have filled the Didcot bill of our anonymous friend quoted above.

The *rôle* of these three engines was for two

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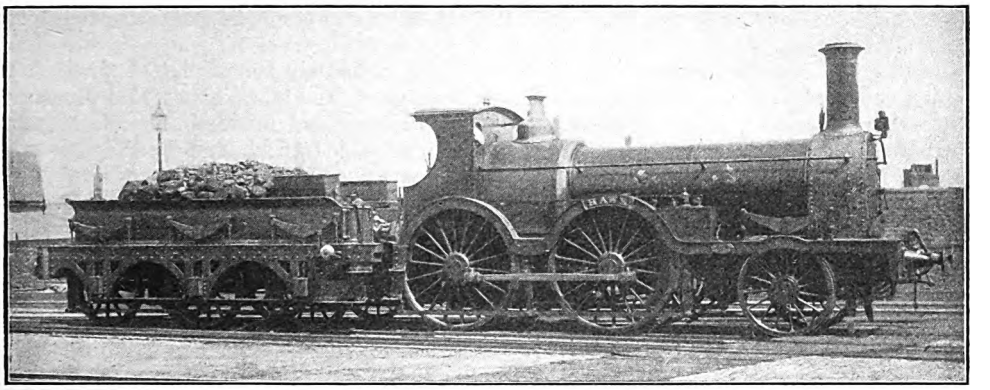
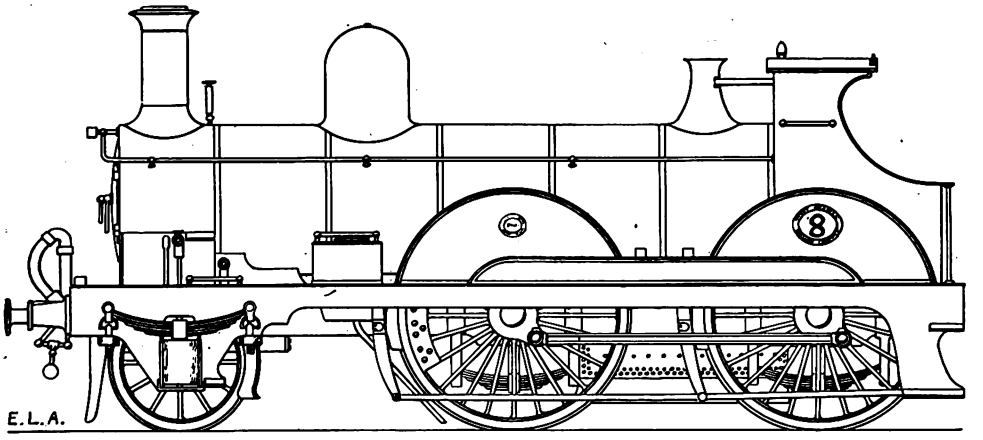


6 FT. COUPLED BROAD GAUGE PASSENGER ENGINE *Hawk*.

of them to stand pilot at Swindon on alternate days in charge of the two oldest broad gauge drivers, on which job they put in a mileage of about 1½ per day, and did it well. The third was retained as a spare engine to be requisitioned when either of the other two became exhausted. Of course, if one of the 8 ft. singles had to give up its train, then the pilots had reluctantly to take a hand, and occasionally go down to Bristol, but I cannot recollect a single instance of their services being required between Swindon and London, and this, it may be added, speaks volumes for the excellent condition in which the main line 8 ft. engines were kept.

Suddenly, early in 1886, a bolt fell from the blue on to the peaceful Swindon pilots, and they were put down to work a regular daily train. The manner in which this came about was as follows. I have already referred to the 3 o'clock up train from Bristol, which left Cornwall in the morning at what was probably the most convenient hour for the ordinary traveller. Moreover, it carried third class passengers, and being sandwiched between the up "Dutchman" and up "Zulu," into both of which the third class passenger was forbidden to set his foot, the train in question gradually became *the* up West of England express of the day, and assumed proportions as to load which were utterly beyond the powers of one 8 ft. single.

Until about the end of 1885, the London engine which had worked down with the 5.30 a.m. newspaper train to Bristol, returned with the 3 o'clock "up" from the latter place, and invariably had to be piloted as far as Swindon, generally by a second 8 ft. single from Bristol shed, and sometimes by coupled engines of the "Avonside" and 2015 classes, for on several occasions the train had "stuck" in the Box tunnel. The load was usually nine, and sometimes as many as eleven 8-wheeled coaches, and it took the two big-wheeled engines all their



FOUR-CYLINDER (TANDEM) COMPOUND BROAD GAUGE ENGINE NO. 8, SWINDON, 1886.

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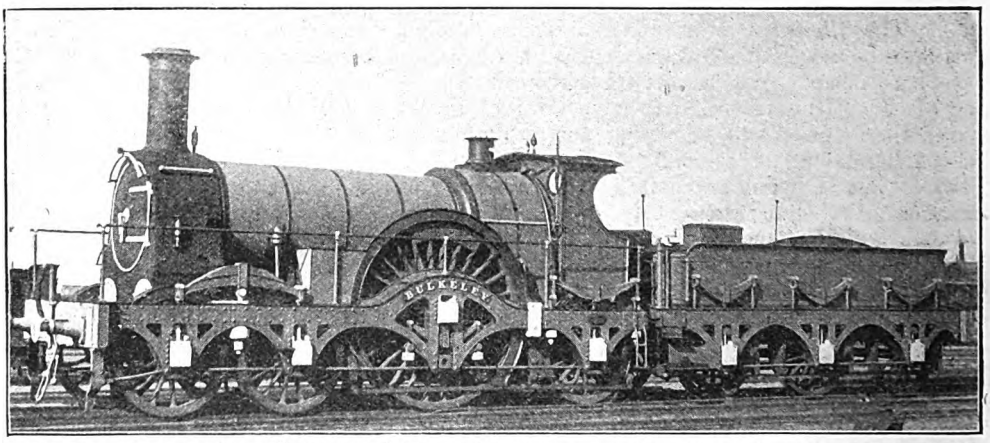
time to climb the 2 mile rise of 1 in 100 through the tunnel, out of which they usually emerged at an almost imperceptible crawl. Then it occurred to the running department that perhaps a coupled engine would be more suitable for this train, and it was decided that the London engine should come off the down newspaper train at Swindon, and that one of the Swindon coupled pilot engines should take its place as far as Bristol, in order to work the 3 o'clock back to Swindon. But, even after this change, it generally happened that *Acheron*, *Phlegethon* and Co. had to requisition the services of a Bristol pilot, so that matters were only improved to a slight extent, and the once placid countenances of the Swindon pilot drivers began to wear a very worried look.

It was at this period—the spring of 1886—that the little known four-cylinder broad gauge compound engine No. 8 was built. No. 8 bore this number in place of a name, for it was constructed on the convertible system, *i.e.*, by changing the axles it could be converted to a standard gauge engine. The broad gauge engines of the Great Western proper had names only but no numbers. Those taken over from the Bristol and Exeter Railway had the Great Western Railway numbers 2001 to 2095, but never possessed names, and the South Devon stock, which became Great Western Railway 2096 to 2180, had both names and numbers. A considerable number of these names were the same as those of the Great Western engines proper, so that there were many cases of two engines having the same name. "Convertible" engines were numbered with the narrow or standard gauge stock and were nameless.

No. 8 had six frame plates, of which the inside and "middle" ones would correspond to the inside and outside frames of a standard gauge double framed engine, and in fact when the engine came to be converted they would become such. In a broad gauge engine the wheels were placed outside both frames, and in addition No. 8 had a third pair of frames which provided outside bearings for the leading pair of wheels, as well as a deep angle plate upon which the side platform rested. The chief feature, however, was in the four-cylinders, which were arranged inside in tandem fashion, with the larger low pressure ones in front. The high pressure cylinders, 14 in. diameter by 21 in. stroke, had the usual form of piston rods screwed into crossheads, but in place of front tail rods connected to the low pressure pistons, there was no direct rod connection between the pistons of the high pressure and the low pressure cylinders. In place of the more usual tandem arrangement, the low pressure cylinders, 22 in. diameter by 21 in. stroke, were arranged each with two piston rods, which were screwed into the pistons at the sides instead of in the centre. These rods issued from glands in the back castings and passing outside the high pressure cylinders were connected to the same crossheads as the high pressure pistons, so that each crosshead formed the connection for three piston rods. The arrangement was similar to one used for twenty 8-wheels-coupled compound coal engines designed by the late Mr. du Bousquet for the Northern Railway of France. In



ONE OF THE LATER 8 FT. "SINGLES," GREAT WESTERN RAILWAY. BUILT AT SWINDON IN 1880.

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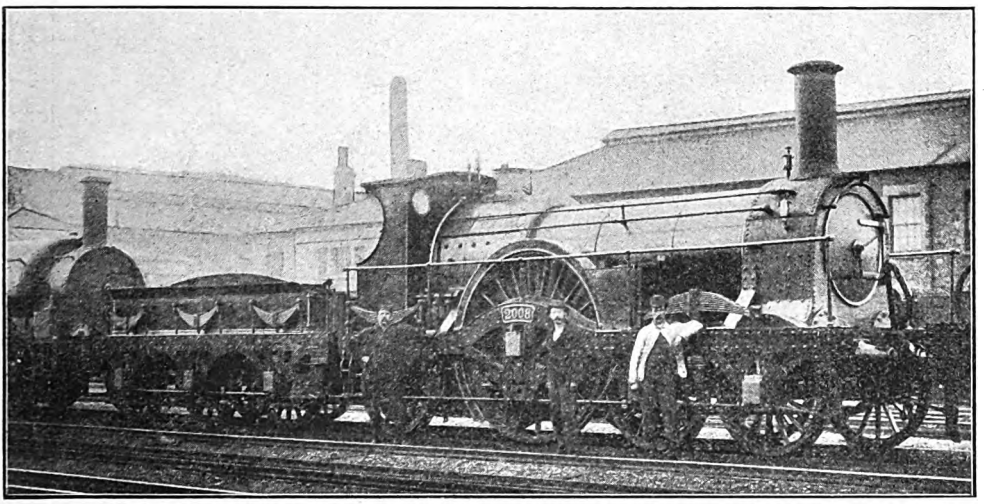
other respects No. 8 looked like an ordinary 2–4–0 express engine. The coupled wheels were 7 ft. in diameter, and the boiler had 1,258 sq. ft. of heating surface, and carried 180 lbs. pressure. The weight on the coupled wheels was 31¾ tons, and the total weight was 45¼ tons in working order.

Had No. 8 had a longer existence it is probable that she would have been used exclusively for the 3 p.m. from Bristol, which was in sad need of a more powerful engine. But she was an unfortunate machine, and things happened to her. She ran but a few hundred miles, and as I was on the footplate during most of her trips, I have a vivid recollection of these happenings. To begin with she was tried as a light engine for a number of short runs between Swindon and Dauntsey, during which she seemed to behave fairly well except for one or two minor faults such as might occur in any new engine. These having been rectified, it was decided to give her a run on a passenger train, and for a start, the piloting of the celebrated 3 p.m. from Bristol, as between Bath and Swindon, was chosen. The *Acheron* had gone down to Bristol with the down newspaper train as usual, and when old Mr. Jones, her driver, had hooked on to the return 3 p.m. and sent out the daily "S.O.S." signal for piloting help, he was instructed to proceed to Bath, where he would find the new compound engine waiting to help him on to Swindon. At Bath No. 8 was attached in front of the *Acheron*, to the great disgust of Mr. Jones, who scented trouble. There were plenty of us to help him out, for besides the trial driver and fireman, the chargeman fitter and two other individuals were on the footplate. Moreover, Mr. Jones's instructions were to give the *Acheron* only sufficient steam to keep his own engine going, and to leave the work of pulling the train to No. 8.

For about 5 miles all went well, until we reached a point about 10 yards outside the western end of Box Tunnel, when two loud explosions were heard, and amidst the roar of escaping steam we entered the tunnel. It was pitch dark, and a rain of fragments of cast iron mixed with large gun metal nuts was projected against the roof of the tunnel, from which they rebounded like shrapnel on to the footplate. The position was distinctly uncomfortable; no one could tell what had happened, but the driver dare not shut off steam or the train would have "stuck" on the 1 in 100 rise, for had this occurred all the efforts of Mr. Jones and the *Acheron* would have been useless.



7 FT. 6 IN. SINGLE ENGINE, NO. 2008, ORIGINALLY BRISTOL AND EXETER RAILWAY ENGINE.

As a matter of fact, No. 8 had smashed to bits three of her four pistons and cylinder covers, the fragments and nuts from which had broken the ports and been blown out of the chimney. Luckily no one was hurt, but one or two of us were hit on the shoulders by gun metal nuts. The fourth piston—one of the high pressure ones—was fortunately intact, and by keeping steam on we just managed to crawl out of the Corsham end of the tunnel, the *Acheron* keeping the train moving. At Chippenham we were pulled off

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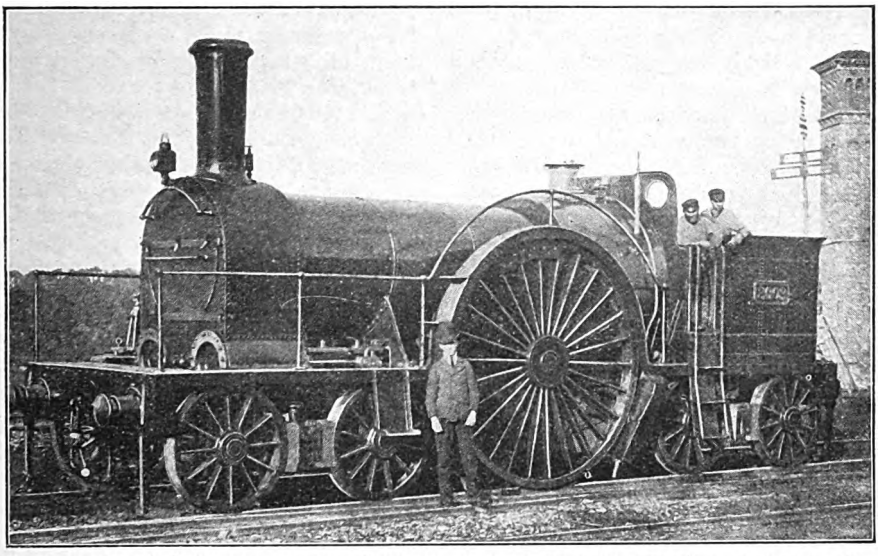
1885 and 1889, 2008 and 2011 being, I believe, the last at work.

Moreover, there were also two very celebrated 8 ft. singles—Nos. 2001 and 2002—of quite a different type. These had inside frames throughout and leading bogies, and were the first 4–2–2 engines with bogies in the country, except the Great Northern Sturrock No. 215, which, however, had an old-fashioned outside framed bogie of quite a different design. Nos. 2001 and 2002 had 8 ft. wheels, 4 ft. bogie wheels, and 18 in. by 24 in. cylinders, but the boilers were considerably smaller than the Gooch engines.

These were engines with a history. Originally built at Bolton by Messrs. Rothwell in 1853–4 to the designs of Mr. Pearson, of the Bristol and Exeter Railway, they had been 4–2–4 well tank engines with two bogies and 9 ft. driving wheels. Four of them were rebuilt in 1868–1873 with 8 ft. 10 in. driving wheels, and the 16½ in. by 24 in. cylinders were enlarged to 18 in. by 24 in. These four engines became Nos. 2001 to 2004 on the absorption of the Bristol and Exeter Railway by the Great Western Railway, and a very short time afterwards, in July, 1876, No. 2004 ran off the road at Long Ashton, near Bourton, when working the up "Dutchman" from Exeter to Bristol.

I forget the exact details of this bad accident, but I believe it was attributed in some way to the engine parting from one of the bogies. After this event the Great Western Railway reduced the driving wheels to 8 ft. diameter and made the new driving tyres with flanges, for until then they had been flangeless. Moreover, the trailing bogie was removed, and a single pair of 4 ft. 6 in. wheels was substituted, and the engines were converted into tender engines. Nos. 2003 and 2004 were broken up in the early "'eighties," but 2001 and 2002 remained at work until the abolition of the broad gauge in 1892, and took their regular turns with the Gooch 8 ft. engines stationed at Bristol.

A peculiar feature of 2001 and 2002 was the immense size of the driving axle-boxes in the inside frames. With a slight enlargement they would have made excellent triumphal arches, and as their weight was naturally in proportion to their size, the arrival of these engines in the Swindon repairing C shed was not heralded with any great amount of enthusiasm on the part of the "gang" allotted to repairing them. As I had my turn at them, I can write feelingly on the subject.



9 FT. SINGLE 4–2–4 TANK ENGINE (BRISTOL AND EXETER RAILWAY) AS REBUILT BY THE BRISTOL AND EXETER RAILWAY, 1873.

At this point perhaps I may be allowed to digress somewhat and return to Swindon shops, more particularly the C shed, in which all the broad gauge express engines were repaired under the chargemanship of Mr. William Cave. Mr. Cave, or "Bill," as he was generally called, was one of those good-hearted leading hands whose knowledge was always at the service of any journeyman,

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pupil or apprentice placed under his charge, and in return he was always regarded with affectionate respect. What Mr. Cave did not know concerning broad gauge express engines was not worth knowing. He was a walking encyclopædia of detailed dimensions, and knew every one of them by heart. This was just as well, for there were no drawings of the celebrated 8 ft. singles, the old drawings of 1847 having become quite obsolete, since all the dimensions had been altered. About 1888 drawings were begun, as it was considered better policy to have some record, and for every dimension that found its way into those drawings Mr. Cave had to be consulted. This work formed one of the drawing office "stock jobs," and I am not sure that they were ever completed. A good many of us did bits at them until called away to something more urgent.

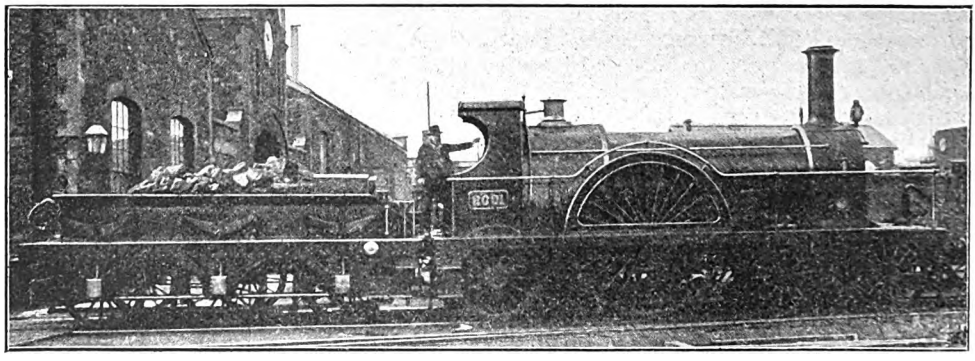
Mr. Cave and his "gangs" were generally a very happy family so long as the standard "Iron Duke" class formed the only engines under repair, but no sooner did 2001 or 2002 put in an appearance than an indefinable irritability became apparent. They were somewhat awkward engines to get at, and those axle-boxes always put a finishing touch to a somewhat charged atmosphere. (Readers will perhaps kindly excuse the mixed metaphor.)

Returning to Bristol after this digression, mention may be made of one isolated single express tank engine of the 4–2–4 variety, No. 2005. This had 7 ft. 6 in. driving wheels and 16½ in. by 24 in. cylinders. It was built by the Bristol and Exeter Railway in 1862, and was very similar in appearance to the larger tank engines with 8 ft. 10 in. wheels, but, unlike the latter, it was not converted to a tender engine. I am not certain whether 2005 was stationed at Bristol or kept at Newton Abbot as a spare engine. I saw it frequently at Swindon and also at Bristol shed, but never on a train.

The "single" tender engines at Bristol worked the whole of the regular main line express and fast trains between Bristol and Newton Abbot, for there were no express engines stabled at the latter station, and Exeter was a "narrow-gauge" shed. The Bristol engines, as stated previously, also worked the up "Dutchman" to Paddington and returned thence with the 5.0 p.m. down fast.

Between Bristol and Newton Abbot there was one additional broad gauge fast train in each direction, other than the through trains previously given between Bristol and London. The stopping trains between Bristol and Exeter were "standard" gauge, for these ran *viâ* the Weston-super-Mare loop, on which there was no broad gauge track.

The only expresses worth detailed mention were the "Dutchman," "Zulu," "Jubilee" and, after 1890, the "Cornishman" in both directions. Of these the down "Zulu" left Bristol at 5.41 p.m. and reached Taunton, 44¾ miles, at 6.32 p.m., giving a running speed of 52·6 miles per hour. Leaving Taunton at 6.35 p.m., the speed thence to Exeter, where the train was due at 7.14 p.m., was 47·3 miles per hour. Both these runs were really very good; the first section was fairly level, with the exception of a rise of nearly five miles of 1 in 440 and 1 in 200 from Bristol to near Bourton and a similar fall thence through Nailsea. The second run, however, included the stiff Wellington bank from Norton Fitzwarren to Whiteball Tunnel, which begins with [illegible] miles of 1 in 209 and 1 in 167 to Wellington and finishes with about 2½ miles of 1 in 90



NO. 2001 (REBUILT AS 8 FT. SINGLE BOGIE ENGINE). ORIGINALLY BRISTOL AND EXETER 9 FT. 4–2–4 TANK ENGINE.

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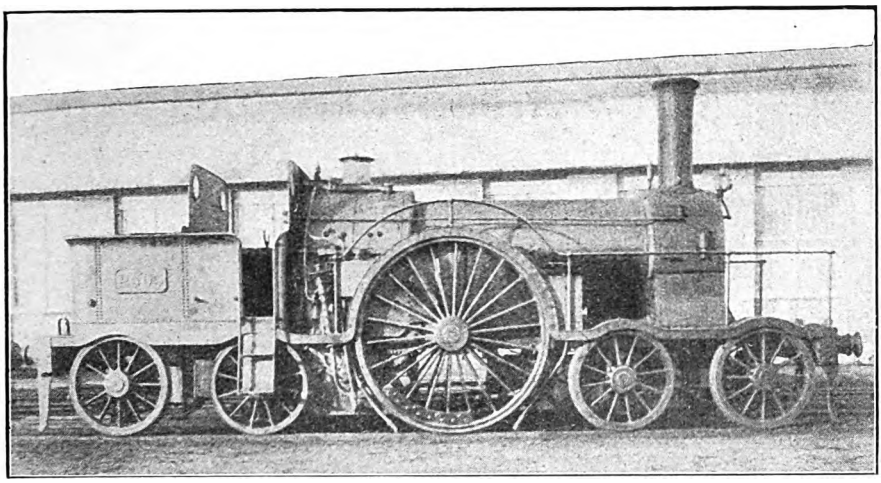

NO. 2005, 7 FT. 6 IN. 4–2–4 TANK ENGINE. ORIGINALLY BUILT BY THE BRISTOL AND EXETER RAILWAY IN 1862.

and 1 in 81 and one mile of 1 in 126 to the tunnel. This very stiff piece of road usually necessitated the services of a pilot engine from Taunton to the tunnel, though when the load did not exceed five 8-wheeled coaches the 8 ft. singles in good weather frequently went up alone, and any time lost was regained down the long descent from the tunnel to Exeter, a stretch of 20 miles varying from 1 in 115 at the top to about 1 in 220 at the bottom.

As might naturally be expected, the best speeds of the old broad gauge engines were performed on the downhill stretches of this section, and, generally speaking, the speeds between Bristol and Exeter were better than those between London and Bristol. The 20 level miles from Exeter to Newton Abbot included a single line section through Parson's Tunnel at Dawlish, and also the Teignmouth stop, so that express speeds terminated at Exeter. On the up journey the "Zulu" left Newton Abbot at 3.15 p.m., Exeter at 3.55 p.m. and accomplished a really good performance in running from Exeter to Taunton (due 4.33) at 48·5 miles per hour. Leaving Taunton at 4.37, it arrived at Bristol at 5.29, an average speed of 52·6 miles per hour.

It was with this train and over this section that I registered the highest speed that I ever experienced, not only on the broad gauge, but also on any railway, until many years afterwards. Hitherto my best records had been 76 miles per hour with a Midland 7 ft. coupled engine and 76·6 miles per hour with a Great Northern 8 ft. single.

The engine was the *Lightning*, on the footplate of which I was riding from Newton Abbot, and the load was 5 eight-wheeled broad gauge coaches, the exact weight of which I do not know, but which I estimate approximately at 120 to 125 tons without passengers or luggage. The maximum speed down the Wellington bank was just over 81 miles per hour. I should add that this timing was not made with a *stop* watch, and therefore, though nearly correct, may not be absolutely so.

I have not mentioned the "Dutchman" on this section. It was a somewhat heavier train than the "Zulu" and had more difficulty in keeping time, especially between Exeter and Taunton.

I have stated that the Bristol express engines and drivers had the "exclusive use" of the Bristol and Exeter broad gauge road. This is almost correct but not absolutely so, though quite true as far as the ordinary express and fast trains were concerned. But the Friday morning excursion from Paddington was at one time worked through to Newton Abbot by the London engine. I am not sure, but I believe this engine remained at Newton Abbot for the week, and the men came home as passengers. This seemed to be a somewhat wasteful method of working, but I understood that the underlying idea was to keep the London men acquainted with the Bristol and Exeter road in case of emergency.

(*To be continued.*)

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THE RAILWAY PORTRAIT GALLERY.

MR. C. CUMMING,
Locomotive, Carriage and Wagon Superintendent,
Highland Railway.

MR. C. CUMMING has been appointed to this position in succession to Mr. F. G. Smith, who has resigned. The new superintendent commenced his railway career as locomotive engineer with the North British Railway at Ladybank, and finished his apprenticeship in the drawing office at Cowlairs, being engaged for some time afterwards at the Cowlairs works and at other locomotive depôts. He was subsequently appointed assistant locomotive foreman at Dundee, and locomotive foreman at Hawick, Thornton, Parkhead, and Burntisland. The next position taken was that of district locomotive superintendent for Fife and the northern sections of the North British Railway, an appointment now relinquished to take charge at Inverness.

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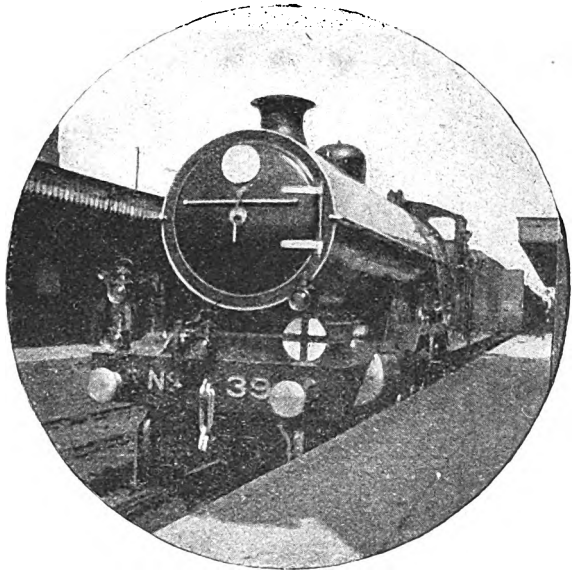
British Locomotive Practice and Performance.

By CECIL J. ALLEN.



Photo] [*R. E. Thompson.*

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.

4-4-2 engine No. 39, *La France*, at Barnham Junction.

THE generosity of correspondents in all parts of the country—and, indeed, in various parts of the world—in the matter of runs, not to mention my own by no means inconsiderable store, renders possible a still further review of the work of 4-4-0 express locomotives, after which I think we may claim to have illustrated adequately the activities of that peculiarly British type. Some runs in Ireland shall claim first attention, especially as it is not often that I have an opportunity of dealing with the by no means uninteresting locomotive work of that country.

A friend now engaged on railway work in Burma sends a typical example of performance on the Great Northern Railway of Ireland, the train concerned being the 5 p.m. "Limited Mail" from Belfast to Dublin. This run was made prior to the recent accelerations, and the engine—*Pandora*, a non-superheater 4-4-0—appeared to have no difficulty in improving on schedule time. From Belfast the load was 226 tons empty, or 235 to 240 tons with passengers and luggage, and the start was inclined to be sluggish, 13 min. being taken for the first 7½ miles to Lisburn. But the next 12½ miles to Lurgan, mostly on a gradually rising grade, were covered in 14 min. 5 sec., and Portadown, 25 miles, was reached in 33 min. The working time for this stretch was then 32 min. At Portadown the Londonderry portion was detached, leaving an empty load of 186 tons (195 tons full) to go forward over the arduous climb of 8½ miles (mainly at 1 in 105) to Bessbrook Summit, where the western spurs of the Mourne Mountains are crossed at an altitude of 522 ft. Tandragee, 5½ miles, was passed in 8¼ min., and Goraghwood, 15¾ miles, in 19¼ min., despite the usual service slacks at Poyntzpass and Scarva, to 30 and 20 miles per hour respectively. The average speed over the concluding 4 miles of the climb was 35·1 miles per hour, and Bessbrook Summit, 22 miles, was passed in 29¾ min. Very moderate speed followed on the descent to Dundalk, with several applications of the brake, but the start-to-stop journey of 33¼ miles was accomplished in 42¾ min., against 45 min. scheduled. The remainder of the journey called for no special effort, the time occupied from Dundalk to Drogheda, 22½ miles, being 29 min. 10 sec., and from Drogheda to Dublin, 31¾ miles, 38 min., start-to-stop in each case. Both stretches are easily graded, the times then allowed being 30 and 39 min. respectively. So at the close of the journey *Pandora* had 3 min. 5 sec. to her credit. Since the introduction of superheater locomotives, however, these times have been curtailed, and the new schedule entails first-class locomotive work. For instance, the allowance from Belfast to Portadown has been cut to 30 min.—a smart time, this, for a 25 miles' journey, with an uphill tendency

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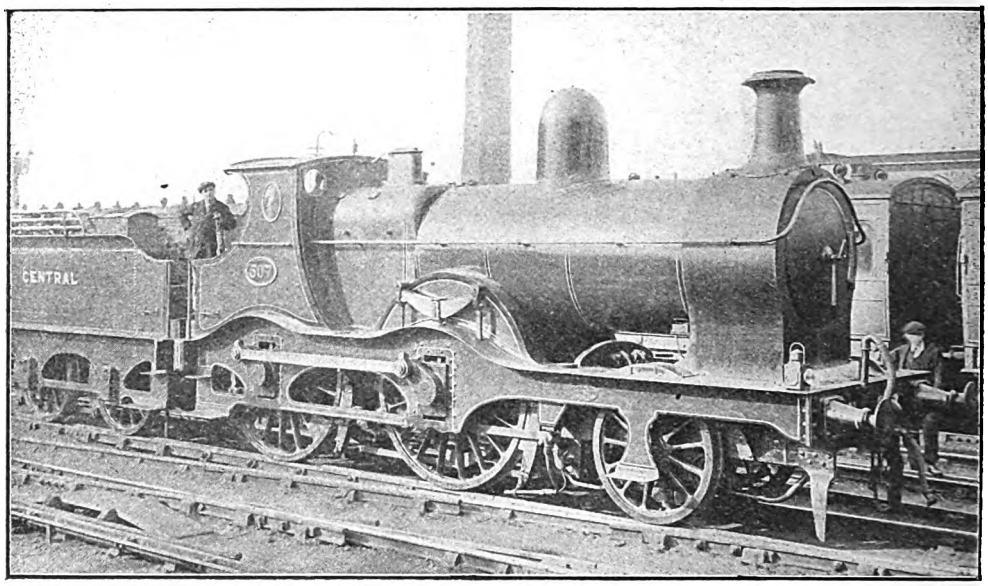

Photo] [*P. F. Cooke.*

GREAT CENTRAL RAILWAY.
NO. 507 (ORIGINALLY NO. 17), OF MR. PARKER'S EARLY DESIGN, AS RECENTLY REBUILT BY MR. J. G. ROBINSON.

This engine, in its original form, was referred to in the October number by Mr. E. L. Ahrons.

—that from Portadown to Dundalk to 43 min., and from Dundalk to Drogheda to 28 min. On the other hand, the Drogheda-Dublin booking is increased to 40 min., although the preceding express has only 38 min. allowed. These times, with their successive averages of 50·0, 46·4, 48·2 and 50·1 miles per hour respectively, represent an aggregate gain of 10 min. on the best previously in force, and do great credit to railway enterprise in Erin.

The same correspondent sends details of an excellent journey on the Great Southern and Western Railway of Ireland from Ballybrophy to Dublin. One of the six large-boilered 5 ft. 8½ in. 4–4–0 class engines, built more especially for use on the boat trains over the heavily graded Cork-Rosslare route, was at the head of the train, but it is evident from these details that engines of this type are equally at home on fast main line service, despite their small wheels. The load throughout was moderate, only totalling 156 tons empty, or 165 tons with passengers and luggage. A feature of the running was the rapidity of each start. From Ballybrophy No. 340 passed Mountrath, 7¼ miles, in 9½ min.; Maryborough, 15¾ miles, in 18½ min. (booked 20 min.), speed falling only to 51·4 miles per hour on the ascent to the latter place; and reached Portarlington, 25 miles, in the very smart time of 28 min. 10 sec. This is a conditional stop, the passing time at Portarlington being shown as 30 min. from Ballybrophy. Signal checks and stops on account of a Waterford train ahead spoiled the next section to Kildare, but from Kildare to Dublin fine running was made. The first 2½ uphill miles to Curragh were tackled in 5¼ min., and Newbridge, 4½ miles, was passed in 7 min. 20 sec. From here, on the undulating but gradually falling stretch to Dublin, the small-wheeled engine ran freely, covering the 7½ miles from Newbridge to Sallins in 7 min. 35 sec., and the 13½ miles thence to Clondalkin in 13 min. 20 sec. So Clondalkin, 25¾ miles, was passed in 28¼ min., but a cautious descent of the sharp fall into Dublin rather adversely affected the total time, the last 4½ miles taking 7 min. 10 sec. Even then, however, the time of 35 min. 25 sec. from Kildare to Dublin, 30 miles, showed a praiseworthy economy of over 1½ min. on the 37 min. scheduled.

From another correspondent I have received details of a run in the same direction behind the new large superheater 4–4–0, No. 341, *Sir William Goulding*. In this case the train was the up "diner" from Cork to Dublin, and the load was much more substantial, totalling 300 tons behind the tender.

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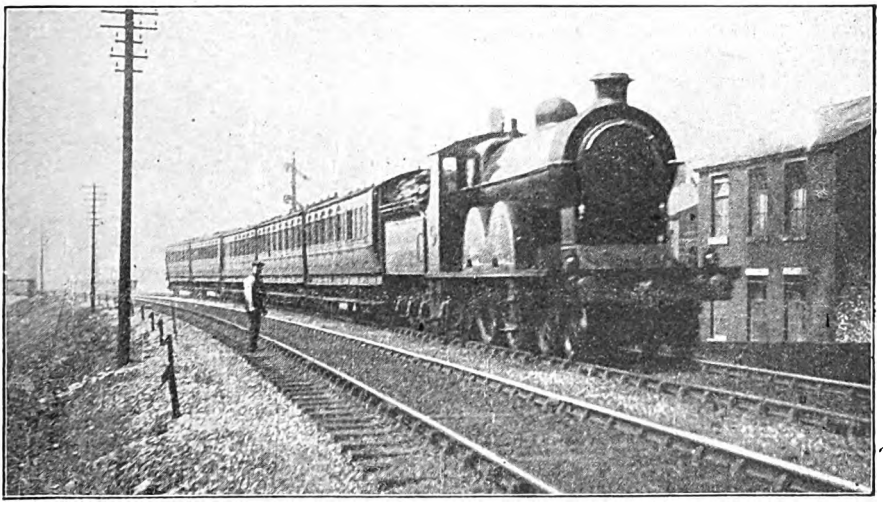
Only the Maryborough-Dublin stretch was timed. Once again smart starts were recorded, No. 341 passing Straboe, 3¼ miles, in 5 min. 35 sec.; Portarlington, 9¼ miles, in 11 min. 55 sec.; Cherryville Junction, 18½ miles, in 21 min. 54 sec.; and Kildare, 21 miles, in 25 min. To Kildare the time allowed is 27 min. The ascent of 5 miles from Cherryville past Kildare to Curragh took 6 min. 51 sec., and Newbridge, 25½ miles, was passed in 31 min. 5 sec. After this a fine speed exhibition was given, the 7½ miles from Newbridge to Sallins taking only 7 min. 2 sec., and the 13½ miles thence to Clondalkin 12 min. 28 sec.—total, 21 miles in 19½ min. exactly. The highest speed recorded was a sustained 68 miles per hour. A still more leisurely descent into Dublin was made on this occasion, so that although Clondalkin, 46½ miles from Maryborough, had been passed in 50 min. 37 sec., the complete journey of 51 miles from Maryborough to Kingsbridge took 58 min. 40 sec. Even this, however, involved a curtailment of booked time by 4 min. 20 sec., and demonstrated clearly the capacity of the new engine.

Finally I may mention one further run, also from the last-mentioned correspondent, in the opposite direction of running. By way of contrast the engine in this case was a small 4–4–0—No. 87—of the No. 60 class, although the load of 190 tons was quite a moderate one. The train was the 3.50 p.m. *ex*-Kingsbridge, booked to cover the 51 miles to Maryborough non-stop in 65 min. Out of Dublin there is a very steep ascent, the first 4 miles being inclined at from 1 in 84 to 1 in 138, and in this way it took 10 min. 13 sec. to pass Clondalkin, 4½ miles. But very fair running followed, the time from Clondalkin to Sallins being 16 min. 4 sec., and from Sallins to Newbridge 8¼ min. At Ballast Pit Box, ¾ mile east of Curragh Summit, a signal check was experienced, so that the time to Kildare, 30 miles out, was 40 min. 43 sec. But from there No. 87 ran quite smartly, covering the 11⅝ miles to Portarlington in 11 min. 50 sec., and the concluding 9⅜ miles to Maryborough stop in 10 min. 37 sec. The gross time from Dublin was thus only 63 min. 10 sec., or 62 min. net, so that the small engine had quite distinguished herself by gaining 3 min. net on schedule time. Indeed, between Kildare and Maryborough the economy on booked time was over 4½ min. I believe the foregoing runs are quite characteristic of much modern Irish express locomotive work—especially on the two railways cited—which is well worthy of the attention of the timing enthusiast.

Returning now to England, we could hardly claim to have completed our review of 4–4–0 locomotive work were we not to include some details of that performed on the largest British lines—the London and North Western, Great Western, Midland and North Eastern. On the first-named of this quartette the 4–4–0 wheel arrangement has become a positive institution, as embodied in the "George the Fifth" type of superheater engines. For sustained speed on a well-graded road with tremendous loads it would



Photo] [*A. Conville.*

LANCASHIRE AND YORKSHIRE RAILWAY.
Express train, drawn by 4-4-2 engine No. 1421.

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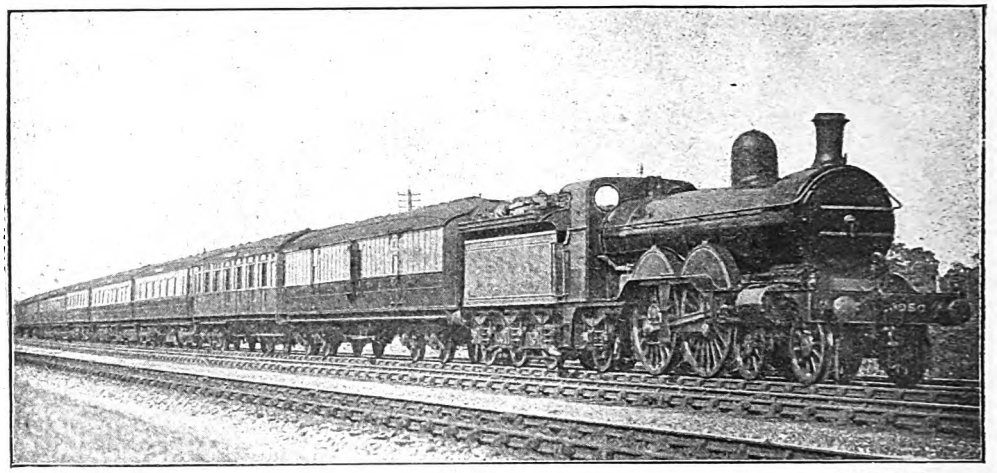

Photo] [*C. Laundy.*

GREAT NORTHERN RAILWAY.

Up Newcastle dining car express, due King's Cross 1.30 p.m. Small "Atlantic" No. 950.

be difficult to find a rival for these remarkable locomotives, fuel and water consumption being duly taken into account. Indeed, they are probably the most successful engines the London and North Western Company has ever had, and prove the advantages of a straightforward design, with ample cylinder and steaming capacity, and no unusual features. The tabulated examples of their work on pages 454 and 456 compare with those of the immediately preceding "Precursor" type of non-superheater engines, while the hauling power in the first run of the down series dates back even further, the engine concerned being one of Mr. Webb's "Alfred the Great" class of 4–4–0 four-cylinder compound engines, converted to two-cylinder simple by Mr. George Whale. I have not often dealt in these columns with the London-Birmingham service of the London and North Western Railway, and a description of these journeys may therefore prove the more welcome. For the first run in the down direction I am indebted to a correspondent in Canada; the next four are of my own timing, while the last four come from a friend at Farnborough, to whom also I owe No. 5 run on the up journey. But now for a more detailed account of the runs themselves.

Chief interest in the first run going north centres in the fact that the train was the well-known "City to City" express from Broad Street to Birmingham, which yielded some noteworthy times, albeit with a very light load. A slack to cross over from slow to fast lines at Sudbury delayed the start from Willesden to Harrow, but thereafter the *Canopus* got away well, climbing from Watford to Tring in the fastest time but two of the whole series. From there followed some downhill running of which my Canadian correspondent was quite proud, but I am interested to find that my Tring-Bletchley times on runs 4 and 5 tie exactly with those on this run. Curiously enough No. 4 run was faster south of Leighton, and No. 5 north of that point, which indicates a "possible" time of even less than 12½ min. from Tring to Bletchley. On this run the maximum speed attained—on a 1 in 330 grade—was 78·9 miles per hour, and the average speed over the 20¾ miles from Tring to Wolverton was as high as 72 miles per hour. Consequently on passing Weedon "even time" had been all but attained, although slight signal checks here and at Hillmorton, just outside Rugby, adversely affected the times between Weedon and Rugby to the extent of about a minute. The net time from Willesden to passing Rugby, therefore, allowing also for the slack at Sudbury, which does not figure in the other runs, would be barely more than 76½ min. Time being now well in hand, moderate running on to Coventry, with a very slow finish, sufficed to ensure a punctual arrival, but the net time for the 88⅝ miles' journey, start-to-stop, did not exceed 89½ min., inclusive of Rugby slack. My own run in column 2 on the 9.31 a.m. down (9.20 a.m. *ex*-Euston), with its original loading prior to the cancellation of the 8.40 a.m. express, has no features of note other than an unusually fast time from Blisworth to Weedon, with a maximum speed—over a

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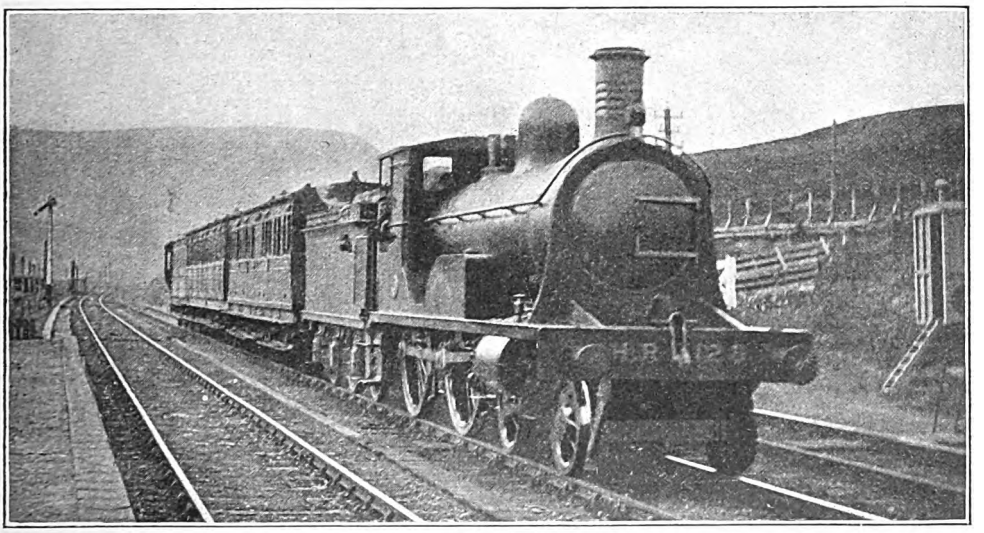
practically level stretch of road—of 71·4 miles per hour. Elsewhere the maximum speed at Leighton was 70·3 miles per hour, and the minima at Tring and Roade 52·3 and 56·3 respectively. But for the final slack outside Coventry we should have economised a minute on booked time. This run was made on the old 92 min. schedule from Willesden to Coventry.

The 8.40 a.m. from Euston to Birmingham, now suspended, had a minute less allowed to passing Coventry, where a coach was slipped, and 22 min. thence to New Street, but never loaded heavily. On the first of the two runs with this train *Erebus* picked up speed very smartly from the start, the time from Harrow to Boxmoor being the fastest of any, and that of 30 min. up to Tring being quite good also. The last 8½ miles up at 1 in 330 reduced the speed to 54 miles per hour, but from that minimum it recovered to 56·3 before Tring was passed. Past Leighton we touched a maximum of 72·5 miles per hour, and then after passing Blisworth the driver eased so noticeably that at Coventry we were nearly a minute behind time, but a smart finish from Tile Hill just saved the situation. The second run on this train—No. 4 in the table—had some curious features. To Watford the start was quite sluggish, but some fine running ensued thence to Tring, second only by 4 sec. to the fastest over this stretch, in column 6. After this there followed some "hurricane" times down Cheddington bank, the maximum speed of 80·3 miles per hour that we touched on this occasion being the only 80 record that I possess on the London and North Western Railway anywhere south of Lancaster. But a succession of very violent storms of wind and rain beyond Bletchley put an end to further racing times, although we comfortably held our own on to Birmingham, arriving 1½ min. early. No. 5 was quite a remarkable trip with a moderate load on the 11.50 a.m. *ex*-Euston. It is necessary in this case, of course, for those consulting the table to add 5½ miles on this run to the mileages there given, which are from Willesden. A good start was made, speed rising to 57·7 miles per hour at Willesden, and 61·6 at Watford, and not falling below 54·4 at Tring. Then followed some exceedingly fast running, with a maximum of 77·5 miles per hour just beyond Cheddington, and a well-maintained speed on the but little easier than level grades that follow to Wolverton. No cessation of effort followed, as the minimum sustained rate at Roade was 58·2 miles per hour (with a brief fall to 55 at the summit, through premature-notching up), and at Kilsby Tunnel 55·6 miles per hour. So the 43⅝ miles from Tring to Welton were covered in 39 min. 5 sec., at an average speed of 67 miles per hour



Photo] [*Tom M. L. Neish.*

HIGHLAND RAILWAY.
2.10 p.m. train, Grantown-on-Spey to Perth, entering Dalnaspidal station, 1,405 ft. above sea level.
4-4-0 locomotive No. 128, *Loch Luichart.*

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throughout. Our net time for the 82⅝ miles from Euston to Rugby, allowing for a signal check at Hillmorton, was only 84 min., and with the easiest running beyond we contrived to reach Birmingham 1½ min. early. No difficulty would have been experienced on this journey in completing the journey in 115 min. by faster running after Rugby.

A feature of the last four runs, in which superheater engines were concerned, is their almost amazing uniformity in times, irrespective of load hauled. From Tring to Leighton, for example, there was no greater variation than 6 sec., from Leighton to Bletchley no more than 4 sec., and from Bletchley to Wolverton no more than 2 sec.! After Wolverton the two drivers who had the lighter loads and had thus made better time up to Tring eased slightly, whereas the other two exerted themselves to regain the arrears, with the consequence that the four trains "drew level" and the passing times at Rugby were all actually within 11 sec.! Thence to Brandon three of the times agreed within 1 sec., while the fourth driver's continued effort was cut short by a signal check outside Coventry. Eventually, however, the start-to-stop times from Willesden to Coventry on the four runs, delays included, showed no variation greater than 12 sec., which is the more astonishing in that they involved an economy of over 3 min. on the schedule of one of the fastest trains on the line, in most

LONDON AND NORTH WESTERN RAILWAY. LONDON–BIRMINGHAM.

Distance (miles)	Run No.	1	2	3	4	5	6	7	8	9
	Train	5 45 p.m.	9 31 a.m.	8 52 a.m.		†11 50 a.m.	9 31 a.m.			
	Engine No / Engine Name	1913 *Canopus*	665 *Mersey*	564 *Erebus*	1102 *Thunderbolt*	302 *Greyhound*	2220 *Thunderer*	1725 *John Bateson*	896 *George Whale*	
	Engine Type	§4-4-0	4-4-0 "Precursor"				4-4-0 "George the Fifth" (superheater)			
	Load (axles) / Load (tons)	18 / 135	‡24 / ‡180	*26 / *195	*28 / *210	28 / 215	¶35 / ¶270	¶44 / ¶350	‡40 / ‡305	‡47 / ‡350
		M. S.	M. S.	M. S.	M. S.	M. S.	M. S.	M. S.	M. S.	M. S.
0	Willesden dep.	0.00	0.00	0.00	0.00	‖9.15	0.00	0.00	0.00	0.00
6	Harrow .. pass	g 9.11	8.20	8.30	9.15	15.45	8.11	8.42	8.02	8.43
12	Watford .. ,,	15.39	15.00	14.45	16.00	22.20	14.32	15.23	14.34	15.13
19	Boxmoor .. ,,	22.53	22.35	22.00	23.10	29.35	21.44	22.47	b 22.07	22.33
26⅛	Tring .. ,,	30.35	30.45	30.00	30.55	37.20	29.13	30.43	30.09	30.37
34⅝	Leighton ,,	37.37	38.20	37.25	37.55	44.35	36.47	38.18	37.43	38.17
41⅛	Bletchley ,,	43.05	44.05	43.05	43.25	49.50	42.21	43.48	43.13	43.48
46⅞	Wolverton ,,	47.52	49.10	48.20	48.45	54.35	47.21	48.46	48.13	48.48
54¼	Roade .. ,,	55.14	56.30	56.30	56.35	61.35	54.56	56.02	55.35	56.03
57¼	Blisworth ,,	58.07	‡59.30	59.45	59.45	64.35	¶58.02	¶59.04	‡58.37	‡59.05
64	Weedon .. ,,	64.22	65.20	66.45	66.15	70.55	64.24	65.10	64.47	65.13
69¾	Welton .. ,,	e 70.30	70.50	72.45	71.35	76.25	69.56	70.27	c 70.16	70.29
77⅛	Rugby .. ,,	f 78.38	78.50	80.30	79.20	f 84.30	77.20	77.21	77.27	77.31
83¾	Brandon .. ,,	85.52	85.50	87.50	87.05	91.50	84.28	84.28	84.34	84.17
88⅝	Coventry .. ,,	91.30	a 92.20	*92.50	*91.20	96.35	d 89.41	89.44	89.46	d 89.53
92⅛	Tile Hill .. ,,	—	—	96.50	95.05	100.25	—	—	—	—
97½	Hampton ,,	—	—	102.10	100.25	106.25	—	—	—	—
103¾	Stechford ,,	—	—	107.40	106.05	113.10	—	—	—	—
107½	Birmingham arr.	—	—	112.45	111.35	118.30	—	—	—	—
	Net time (mins.)	89½	91	112¾	111½	†118	89½	89¾	89¼	89½

† *Ex*-Euston. ‖ Passing time *ex*-Euston. § "Simplified" 4-4-0 compound. ‡ 30 tons (4 axles) slipped at Blisworth. ¶ 50-55 tons (8 axles) slipped at Blisworth. * 30 tons (4 axles) slipped at Coventry. a—Severe signal check. b, c, d, e, f—Very slight signal checks. g—Cross-over slack, local to main.

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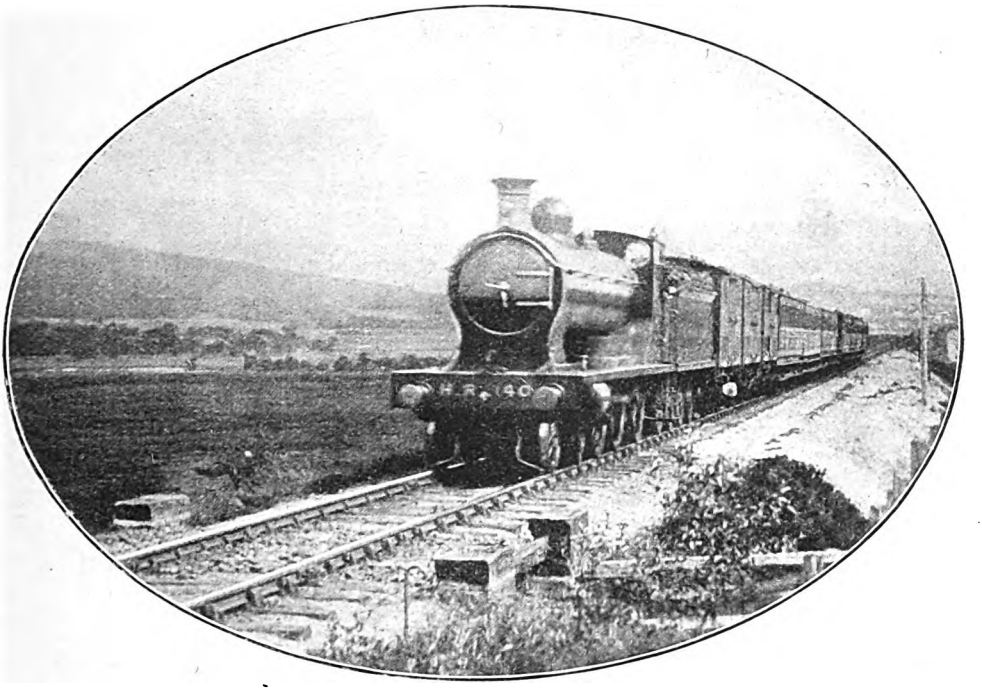
cases with loads well above the normal. The time allowance of the 9.20 a.m. down, it should be explained, has recently been increased by a minute between Rugby and Coventry, making a total of 93 min. from Willesden, but in all the foregoing cases drivers were regaining a slight loss due to overtime spent at the latter junction. In fact, this uniformity characterises the whole series of runs, and it is noteworthy that on the whole of these runs the times made from Willesden start as far as Blisworth show no greater variation at any point than 1¾ min., although on account of delays and other reasons that variation is increased from Weedon onwards.

But to return to the superheater engines' achievements. *Thunderer*, with the lightest load, did the best work to Tring, not falling below 56 miles per hour at the summit, after having attained 62 miles per hour at Watford. *John Bateson* touched 60 at Watford, and fell to 53 at Berkhamsted, afterwards recovering to 54 at the summit; while *George Whale*, in run 8, similarly recovered from 52 to 54 miles per hour, after a maximum of 62 at Watford. Down Leighton bank the maxima were very similar, being 74 miles per hour on runs 6 and 8, 73 sustained on run 7, and 72 sustained on run 9. On the ascent to Roade *Thunderer* was well ahead of time, and the speed on this run fell to 52 miles per hour, whereas in run 8 the minimum was 55 miles per hour, in run 7—56 miles per hour, and in the last run as much as 57 miles per hour. Similarly on the easy grades past Blisworth *Thunderer* was content with a maximum of 65 miles per hour, whereas *John Bateson* touched 70, and *George Whale* the same figure on run 9, and 69 on run 8. With the heaviest load of the series—320 tons—after slipping the Northampton portion, *George Whale* on run 9 made good running up to Kilsby Tunnel, not falling below 59 miles per hour, while on the previous run the same engine recovered to 58 after falling to 56 at Buckby. *John Bateson*, with 300 tons, did not fall below the mile-a-minute rate at this point, but *Thunderer*, still going easily after his magnificent start to Bletchley, dropped to 56 miles per hour, recovering to 57 at the summit. The maxima



Photo] [*Tom M. L. Neish.*

8.40 A.M. INVERNESS-PERTH EXPRESS ASCENDING THE GRAMPIANS, NEAR ETTERIDGE CROSSING.

4-6-0 locomotive No. 140, *Taymouth Castle.*

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at mile-post 81, approaching Rugby, were moderate, ranging from 65-67 miles per hour, and similarly at Brandon, save for a brilliant burst of speed on the part of *George Whale* in run 9, touching 71 miles per hour with 320 tons—a fine achievement seeing that the grade hereabouts is only 1 in 660. Before leaving the down runs it may be well to mention the working times. On the 9.31 a.m. *ex*-Willesden these are—14 min. to Watford, 30 to Tring, 44 to Bletchley, 57 to Roade, 80 to Rugby, and now 93 to Coventry. The 5.45 p.m. *ex*-Willesden, as the 9.31 a.m. in the past, had the same times to Rugby, and then 92 min. to Coventry, while the 8.52 a.m. down was also similarly timed to Rugby, but passed Coventry in 91 min. and reached Birmingham in 113 min. As regards the Euston-Birmingham 2-hour trains, the times are 9 min. to Willesden, 22 min. to Watford, and from Tring onwards the times of the 8.52 a.m. *ex*-Willesden *plus* 7 min.

In the reverse direction I have contented myself with tabulating 5 representative runs, in all cases on 2-hour trains between Birmingham and Euston. The selection of engines involved is interesting. *Daphne* and *Tiger* were, at the time of making the runs, "Precursor" class engines without superheater; *Dragon* is an engine of the same type now superheater-equipped, and therefore not really belonging to the "George the Fifth" class, as does *Miles MacInnes*. *Commodore*, however, is a little 2-4-0 "Precedent," known more familiarly as a "Jumbo," and put up a fine performance, with some quite exceptional features. I have previously described this run in these columns, so a very

London and North Western Railway. Birmingham-London.

Distance (miles).	Run No.	Schedule times (mins.)	1	2	3	4	5
	Train		2.45 p.m.	5.0 p.m.		8.40 a.m.	6.20 p.m.
	Engine No. / Engine Name		478 *Commodore*	216 *Daphne*	1439 *Tiger*	60 *Dragon*	2507 *Miles MacInnes*
	Engine Type		2-4-0	4-4-0 "Precursor"		4-4-0 "George V." (superheater)	
	Load (axles) / Load (tons)		20 / 150	†28 / †210	†34 / †255	36 / 275	40 / 315
			M. S.	M. S.	M. S.	M. S.	M. S.
0	Birmingham	0	0.00	0.00	0.00	0.00	0.00
3¾	Stechford	—	5.55	6.10	6.25	7.00	5.26
10	Hampton	—	12.00	12.25	12.40	13.10	10.50
15⅜	Tile Hill	—	18.00	18.05	18.00	18.25	15.50
19	Coventry	21	21.30	21.15	21.20	21.35	19.00
23¾	Brandon	—	25.45	25.30	25.50	25.35	23.08
30⅜	Rugby	33	32.30	32.55	33.30	32.00	30.20
37¾	Welton	—	41.35	42.25	42.45	41.35	39.21
43½	Weedon	—	46.50	47.30	47.50	46.40	44.21
50¼	Blisworth	—	53.10	†53.45	†54.20	52.50	50.46
53¼	Roade	56	56.05	56.50	57.30	55.45	53.42
60⅝	Wolverton	—	62.50	63.20	64.25	62.25	60.18
66⅜	Bletchley	70	68.25	68.40	70.10	68.00	65.41
72⅞	Leighton	—	75.10	74.55	76.50	74.30	72.09
81⅜	Tring	86	85.20	84.20	86.05	83.35	81.06
88½	Boxmoor	—	93.00	91.20	93.25	90.25	a 89.46
95½	Watford	101	99.15	97.35	100.00	96.40	96.09
101½	Harrow	—	105.00	104.05	106.00	102.30	101.56
107½	Willesden	113	110.25	111.35	111.20	c 109.00	b
113	Euston	120	118.20	119.30	118.50	d 117.55	117.51
113	Net time (mins.)	120	118¼	119½	118¾	115	113

† 30 tons (4 axles) slipped at Blisworth. a—Signals, Berkhamsted, severe. b—Signals, Sudbury to Willesden, severe. c—Signals, Sudbury. d—Permanent way check, Kilburn.

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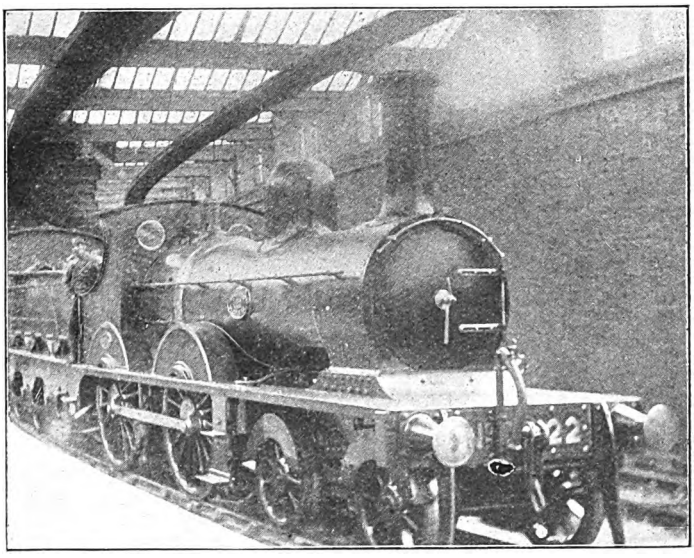
brief note concerning it will suffice. The start as far as Hampton was the fastest but one of the series, and with the assistance merely of some 5 miles down at 1 in 330, we touched 71·4 miles per hour at Coventry. Rugby was passed before time, at reduced speed as usual, and then a really brilliant climb followed to Kilsby Tunnel, the little engine accelerating to 50 miles per hour on the ascent, and only missing by 5 sec. the fastest time of the series from Rugby to Welton. Maxima of 68·1 miles per hour at Weedon and 70·3 at Castlethorpe were separated by a minimum of 57·7 at Roade, and Bletchley was passed over 1¼ min. early. Consequently *Commodore* was eased on the ascent to Tring, and the rate fell to 44 miles per hour, but after further maxima of 70·3 and 69·2 miles per hour at King's Langley and Sudbury respectively Willesden was passed nearly 2½ min. before time. Taking booked time thence to Euston we should have completed the journey in 117½ min.; as it was, with a very easy approach, the time totalled 118 min. 20 sec. The two runs on the 5 p.m. *ex*-Birmingham were of quite an ordinary character, with moderate loads. *Daphne* took matters fairly easily as far as Welton, making good time thence to Roade, with a maximum speed of 70·3 miles per hour at Weedon. After Roade, however, some very fast running took place, a top speed of 75 miles per hour being attained before Castlethorpe, and the times of all other runs between Roade and Bletchley being beaten. In fact this effort continued almost unabated to Watford, the engine gaining all but 4 min. on schedule between Rugby and Watford. South of Watford the running became painfully slow, in order to avoid an early arrival, but, had we observed schedule time from Watford, we should have arrived 3½ min. before time. *Tiger* ran very easily throughout, both uphill and downhill, no higher speed than 69·2 miles per hour being touched anywhere, and arrived comfortably 70 sec. in advance of booked time.

As on the down journey the up runs with superheater engines were altogether superior to those made with engines not so equipped, while the loads also were substantially heavier. *Dragon*, curiously enough, was quite sluggish at the start, taking the longest time of any run as far out as Coventry, but the work greatly improved from Hampton onwards, and beyond Coventry was brilliant. On the level and slightly falling grades to Hampton speed rose to 65·2 miles per hour, and while the 3 miles up at 1 in 330 past Berkeswell reduced the rate to 56·3, the 5 miles down at the same inclination past Tile Hill to Coventry produced a maximum speed of 75 miles per hour. So the Coventry-Rugby time was substantially the fastest of any. The Rugby slack was carefully made, and we then accelerated to 46·4 miles per hour on the 1 in 364 rise to Kilsby Tunnel. Past Weedon we were doing 72·5 miles per hour, and after falling to 57 at Roade, we touched 70·3 on the descent to Castlethorpe troughs. From Wolverton the engine was eased very slightly, but perceptibly, and then kept up the mile-a-minute gait on to the steeper part of Cheddington bank, where speed fell to 52·3 miles per hour before Tring Summit was breasted. From here we ran smartly on to Watford, touching 71·4 miles per hour at King's Langley, but delays south of Harrow prevented a greater gain than 2 min. on schedule from end to end. We had, however, gained



Photo] [*G. Milne.*

FURNESS RAILWAY.

An old photograph, taken nearly 20 years ago, of 4-4-0 engine No. 122, at Carnforth.

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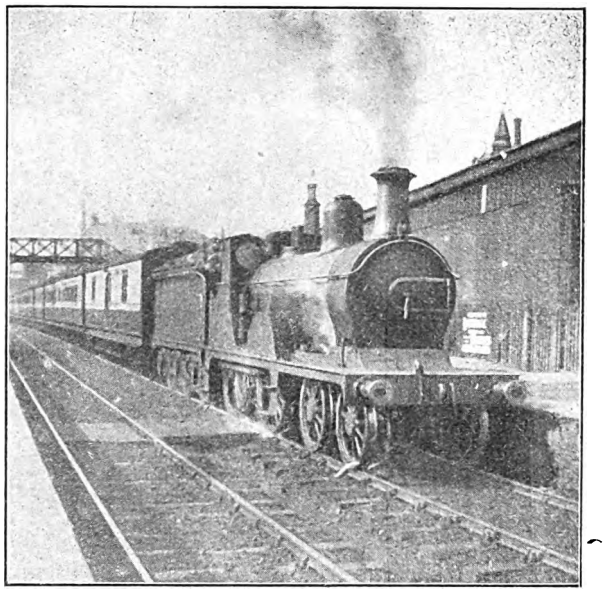
work, although it must be confessed that the load is considerably lightened as the journey proceeds by means of successive slips at Princes Risborough, Banbury and Leamington. My first correspondent made his run before the institution of the Banbury slip, and the load consisted of 9 eight-wheelers to Risborough, 8 to Leamington, and 6 to Birmingham, or 275, 245, and 195 tons respectively, gross weights. The engine was No. 3830, *County of Oxford*. A speed of 50 miles per hour was attained in 2 miles from the start, but the usual slack at Old Oak Common followed. Nevertheless Northolt Junction, 10¼ miles, was passed in 14 min. 10 sec., Beaconsfield, 21⅝ miles, in 25¾ min. and High Wycombe, 26½ miles, was reached in 30 min. 50 sec. Unfortunately my friend gives no speed details, but the uphill work with this load must have been excellent. Similarly in starting from Wycombe, Risborough, 8¼ miles, was passed in 11 min. 20 sec., despite the steep 1 in 164 rise past Saunderton. Some high speed beyond here, exceeding 80 miles per hour, was interrupted by a bad permanent way check, but the 18¾ miles from Risborough to Bicester only took 18½ min., and the 14 miles thence to Banbury 13¾ min. Further very high speed beyond Southam Road was again spoiled by a bad permanent way slowing, but Leamington, 60¾ miles from Wycombe, was passed in 64 min. 5 sec. The remainder of the journey into Birmingham, 23¼ miles, including a good time of 4 min. 40 sec. for the 4 miles largely at 1 in 100–105 from Warwick up to Hatton, occupied 25 min. 25 sec., which made the total time 89½ min. for the 84½ miles from Wycombe, or not much over "even time" net. Indeed, the aggregate time of 121 min. 40 sec. from London, of which 80 sec. were spent standing at Wycombe, and a further 4 or 5 could be credited to delays, was a very good showing for a 4–4–0 engine with this road and load.



Photo] [*A. Willcox.*

GREAT NORTH OF SCOTLAND RAILWAY.

8.5 a.m. train *ex*-Aberdeen, passing Kittybrewster.

The second run was equally good, with a heavier train. The engine was No. 3801, *County Carlow*, driven by Brunsdon, and the load 310 tons to Risborough, 285 to Banbury, 260 to Leamington, where an extensive portion must have been "shed," and finally 160 tons on to Birmingham. On this run the early stages were not quite so good as previously, the time to Northolt being 15 min. 5 sec.; to Beaconsfield 26¾ min.; and to Wycombe 31 min. 53 sec. The minimum rate up Gerrard's Cross bank was 54·5 miles per hour, and the maximum beyond Beaconsfield 73·8. After Wycombe, where a stop of exactly one minute was made, a speed of 45 miles per hour was attained up the 1 in 176 and 164 of Saunderton bank, and Risborough was passed in 12 min. 19 sec.—a time all but a minute inferior to that of the last run. But a maximum of 80·3 miles per hour was touched before Haddenham, and after a rather severe slack for Ashendon Junction a further top speed of 70·3 was attained at Blackthorn, so that the 9⅜ miles from Risborough to Ashendon were covered in 7 min. 53 sec., and the 9⅜ miles thence to Bicester in 9 min. 8 sec. The minimum speed on Ardley bank was 54·5 miles per hour, and with another severe check at Aynho Junction the 14 miles from Bicester to Banbury took 14 min. 27 sec. On the 4 miles of Cropredy bank—3 at 1 in 304–330 and 1 at 1 in 179—the minimum speed was 57·6 miles per hour, while the long descent of Southam Road bank elicited a maximum of 81·8, making the time from Banbury to Leamington only 17 min. 35 sec. The 60¾ miles from Wycombe to Leamington had been covered in 61 min. 22 sec. Relieved of the last slip portion,

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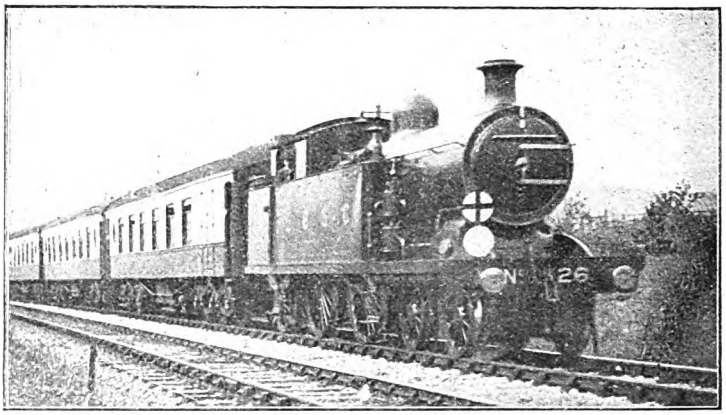

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.
Pullman car express, drawn by 4-4-2 tank engine No. 26.

County Carlow went ahead splendidly with the remaining 160 tons, maintaining 52·9 miles per hour up Hatton bank, and actually 66·6 up the flatter grades at 1 in 183–273 for 3½ miles to Knowle. So the 14 miles from Hatton to Tyseley were covered in the remarkable time of 12½ min., giving a total of 80½ min. for the 80¾ miles from Wycombe. The widening works at Bordesley delayed the conclusion of the run, but the arrival was effected at 11.8.38 a.m., nearly 1½ min. before time, in 85¾ min. from Wycombe, or 84½ net, and 117½ min. net from London. This run offers a very interesting comparison to that of *Miles MacInnes* on the London and North Western Railway from Birmingham to London, both being exceptionally fine examples of 4–4–0 performance.

As regards the Midland Railway I shall have to content myself for the present with detailing one or two runs of unusual merit with which different correspondents have favoured me recently. I will begin first with the work of a "Class 2" engine on the West of England line—the precursor of a series on that interesting route for which I hope to find space shortly—between Bristol and Gloucester. The engine in question was No. 523, a 7 ft. 0½ in. superheater rebuild driven by Plummer, of Bristol shed, and the load 191 tons empty, or 200 tons gross; the train was the 9.45 a.m. Newcastle express. Commencing ½-mile out of Temple Meads station there is a very steep rise for 2¼ miles, mostly at 1 in 69–81, as far as Fishponds, and in consequence the first 5 miles to Mangotsfield, booked 10 min., took 11 min. 5 sec., but the 5¼ level miles thence to Yate were covered in 6 min. 40 sec. Some fast running now ensued, although Wickwar bank is by no means steep, the 7¼ miles of its length averaging only 1 in 281–357; the 6¾ miles from Yate to Charfield were covered in 6¼ min.; the 5 miles thence to Berkeley Road in 4¼ min.; and the 4½ undulating miles terminating at Frocester in 4¼ min. From Frocester to Standish Junction the line rises, 2½ miles of the distance being at 1 in 239–277, but the time taken for this 3½ miles was exactly "even," as was also the time for the final 7 miles into Gloucester. Thus the schedule allowance from Yate to Standish Junction—21 min. for 19¾ miles—was improved on by 2¾ min., and from Yate to Gloucester by 3¾ min., the total time from Bristol to Gloucester, 37 miles, being 43 min., or 2 min. under schedule. Considering the severe rise out of Bristol, this was a very smart journey.

Next in the Midland scale of power progression we have "Class 3," consisting of the Johnson 4–4–0 non-compound engines of the 700 batch, and I have just turned up a very interesting run from another friend, on the now suspended 3.30 p.m. express from St. Pancras to Leeds, in which an engine of this type—No. 775—was concerned. The load was one of eight vehicles, weighing in all 235 tons. In its early stages the run was badly hampered by checks, severe signal slowings from Camden Road culminating in a dead stand at Haverstock Hill for 1¼ min. So the first 12½ miles to Elstree took 24 min. 5 sec., leaving a poor prospect of reaching Kettering in the 76 min. allowed. A maximum speed of 67·7 miles per hour was touched at Radlett, and up the 4½ miles mostly at 1 in 177 past St. Albans the lowest speed was 52·3 miles per hour, so that the 7½ miles from Elstree to St. Albans took 7 min. 25 sec. The 10¼ miles from St. Albans to Luton were covered smartly in 10 min. 40 sec., and then followed a tremendous burst of speed from Toddington down to Bedford, the 10½ miles from Luton to Ampthill taking 9 min. 48 sec., and the 8 miles thence to Bedford only 6 min. 10 sec. My correspondent could not take maxima records here

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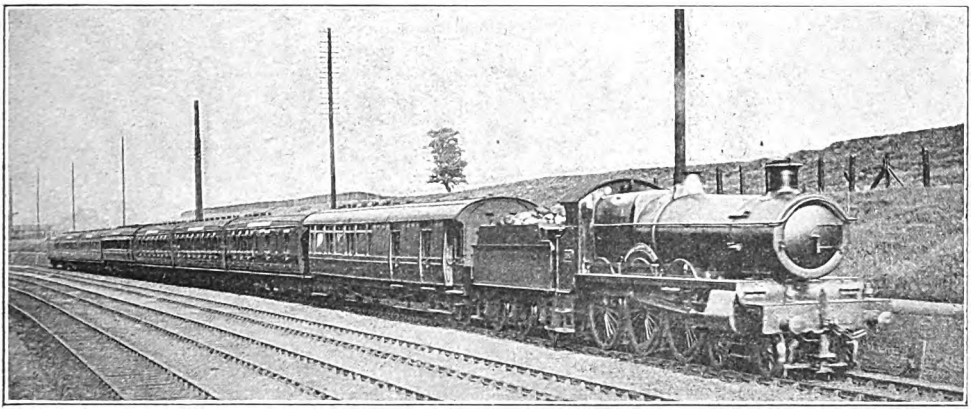
owing to steam obscuring the mile-posts, but the last time indicates an average speed for 8 miles of all but 78 miles per hour. On the ascent to Sharnbrook Summit, culminating in 3¾ miles at 1 in 119, speed fell to 45 miles per hour, but it rose again to 78·3 miles per hour past Irchester, and the 15¼ miles from Bedford to Wellingborough were covered in 15 min. 12 sec. The final 7 miles into Kettering with this train include a bad slack to cross over from fast to slow roads at Kettering South Junction, and so occupied 8 min. 55 sec., but even so the 65 miles from Hendon, passed much more slowly than usual, to Kettering stop had only taken 64 min. 25 sec. Certainly the net time from London did not exceed 75 min. for the 72 miles.

Finally I will mention a remarkable run on the corresponding Sunday train leaving St. Pancras at 4.10 p.m., and having the same booking to Kettering, as illustrating the work of a Midland 4–4–0 engine of "Class 4." The latter was No. 1038, a 3-cylinder compound, driven by Davenport, of Leeds shed, with a load totalling 221 tons empty, or again about 235 tons with passengers and luggage. Starting a minute late, the train was checked to a walking pace at Kentish Town for permanent way repairs, and so took 13 min. 55 sec. to pass Hendon. The minimum speed at Elstree was 51·1 miles per hour, and the maximum at Radlett 70, but a second permanent way check intervened before St. Albans, to 30 miles per hour. Yet a third slack of the same character, this time to 20 miles per hour, occurred at Luton. After this No. 1038 was at last able to "get going" properly, and ran for some distance before Bedford at 81·8 miles per hour, passing the latter town, 49¾ miles, in 58 min. 26 sec. from London. The next 10 miles to Sharnbrook Summit took 9 min. 55 sec., with a minimum speed of 43·7 miles per hour, and after a maximum of 77·5 at Irchester, Wellingborough, 65 miles, was passed in 73 min. 2 sec., and Kettering, 72 miles, was reached in 79 min. 38 sec., or 72¼ min. net. It was noteworthy here that the speed had not fallen below 69·2 miles per hour at Isham before steam was shut off. Re-starting from Kettering, the first 5 miles to Geddington, including 2½ adverse at 1 in 132–160, were covered in 8 min. 27 sec., and then, with a top speed of 80·3 miles per hour at Harringworth, a stop was made at Manton, 18⅛ miles, in 20¾ min.—a most exceptional feat, as my correspondent rightly remarks, considering the nature of the road, and the allowance of 22 min. From here to passing Melton Mowbray, 15⅛ miles further, the time taken was 17 min. 57 sec., despite the initial 4 miles' rise, which includes over a mile at 1 in 143 at the very start. Inclusive of a careful slack for Melton Junction, the 3⅞ miles from Melton up to Grimston, mainly at 1 in 200, took 5 min. 20 sec. Finally, with a maximum speed of 78·9 miles per hour on the falling grades to Nottingham, the 33⅜ miles from Manton to the latter town were completed in 37 min. 25 sec., a further gain of 1½ min. on schedule time. Although the train had started 1 min. late, had stood for more than 2 min. over time at Kettering



Photo] [*F. E. Mackay.*

GREAT WESTERN RAILWAY.

3.35 p.m. down South Wales express, 4-6-0 locomotive No. 2987 *Bride of Lammermoor.*

[Last month this photograph was interchanged with one showing the 3.30 p.m. down West of England express. The illustration on page 390, November number, therefore shows the latter train, the engine being No. 4031, *Queen Mary*, and not as then stated.]

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and Manton, and had lost 7¼ min. by checks, the arrival at Nottingham was only 3½ min. late, the engine having gained in all 6½ min. on this very fast timing. This is equivalent to a non-stop time between London and Nottingham, 123½ miles, of rather under 125 min., and is an achievement reflecting great credit on both driver and locomotive.

I have not left much space in which to deal with the 4–4–0 express locomotive work of the North Eastern Railway, but I have at the very moment of writing enjoyed quite an astonishing run on that line with a 4–4–0 engine that deserves immediate publicity. The engine involved was an R—a 4–4–0 of a class introduced in 1900, and conforming in dimensions generally to the average of engines of this type built in the early part of the present century—No. 1184, lately fitted with superheater, and handled most capably by Gascoigne, of Gateshead shed. A mixed load of eight vehicles was taken, totalling 29 axles, or 200 tons behind the tender, while the train was one of the fastest on the system—the 2.5 p.m. express *ex*-York, through off the Lancashire and Yorkshire line, and booked to cover the 44·1 miles to Darlington in 45 min. The start was brilliant, Beningbrough, 5·5 miles, being passed in 7¾ min., at a speed of 64·3 miles per hour. By the time we passed Alne, on a dead level track, the speed had risen to 69·2 miles per hour, and although this rate was reduced to 67 on the 1 in 805 rise between Raskelf and Sessay, it rose again to 69·2 on the level stretch between Sessay and Thirsk. So Alne, 11·2 miles, was passed in 13 min. 5 sec.; Pilmoor, 16·1 miles, in 17 min. 25 sec.; and Thirsk, 22·2 miles, in 22¾ min. The 6 miles at up 1 in 626 from Thirsk to Northallerton reduced the speed to 64·3 miles per hour, but about here we achieved "even time," and so passed Northallerton, 30 miles, in 29 min. 50 sec. On the level stretch beyond to Danby Wiske we again reached 69·2 miles per hour, while the final rise at 1 in 696 to Eryholme brought us down to 65·2 miles per hour; after this, being before time, Gascoigne "eased" his engine, and ran gently into Darlington, a little time being also lost by a severe permanent way check outside the station. But Danby Wiske, 33·7 miles, had been passed in 33 min. 10 sec.; Eryholme, 38·9 miles, in 38 min.; and Croft Spa, 41·5 miles, in 40 min. 20 sec.; the total time from York to Darlington being 44¼ min. A clear road and a fast run in would have enabled us to complete the journey in 43½ min., or 1½ min. under the very fast booking. In these days, when over sixty vast "Atlantic" engines are taking all the more important express duties of the North Eastern Railway, driver Gascoigne has every reason to be proud of such magnificent running with an engine of comparatively limited tractive capacity. Indeed, with one or two exceptions, the running was finer than any I have timed in this direction behind even the latest 3-cylinder "Atlantics" of class Z. Such runs as these prove conclusively that the 4–4–0 type of locomotive still has before it a large sphere of usefulness in express passenger service.

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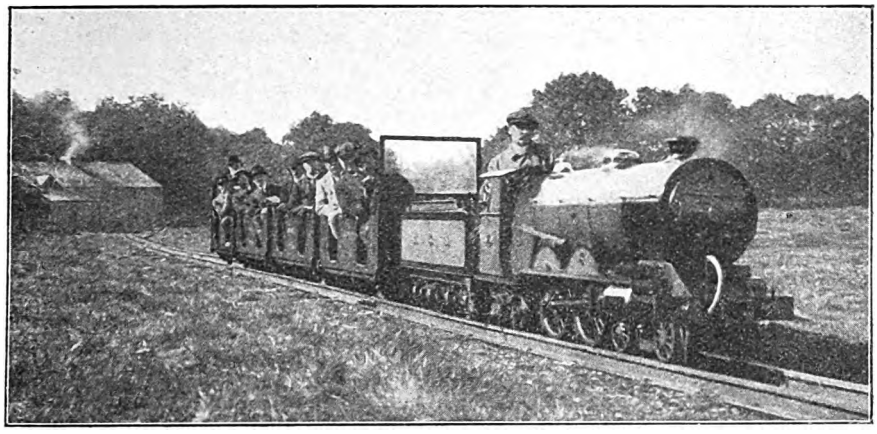

THE "ESKDALE" EXPRESS AT FULL SPEED NEAR MUNCASTER.
The driver is Mr. R. Proctor Mitchell, a director of the Company.

A Novel Miniature Line.

THE RE-OPENING OF THE ESKDALE RAILWAY.

By "VOYAGEUR."

MANY visitors to the English Lake District in past years will have made themselves familiar with the little railway that linked up Ravenglass, on the coast in the south-west corner of Cumberland, and the village of Boot, at the head of Eskdale. But besides being somewhat of a curiosity, this primitive line, of 2 ft. 9 in. gauge, served purposes of real utility in opening up one of the most beautiful parts of the county, otherwise more or less inaccessible. Completed for traffic in September, 1876, the Eskdale Railway was planned to bring down to the coast hematite iron ore from several mines around Boot, but the increasing popularity of the district, both as a holiday and a residential centre, soon resulted in passengers being conveyed also. In the summer the latter traffic was quite heavy, visitors from the manufacturing towns of Barrow, Millom, Whitehaven, the rising resort of Seascale, and other points along the coast in the vicinity, utilizing the opportunity thus afforded of taking the coast line of the Furness Railway to Ravenglass, and from there by the Eskdale line conveniently reaching Wasdale, Wastwater, Eskdale, and the Scawfell district. The last named summit is only three miles distant from Boot, while during the time that the railway remained open, the paths from Boot past Burnmoor Tarn to Wasdalehead, and from Irton Road to Strands, at the head and foot of Wastwater respectively, were quite extensively used by tourists, the distance over the moor to this somewhat remote lake being only four or five miles. Higher up the valley beyond Boot is the Woolpack Hotel, from which a very fair road crosses by Hard Knott and Wrynose Passes over into Langdale and Ambleside, the latter town being only 16¼ miles from Boot. In addition to its scenic charm, also, the Eskdale district is rich in historical ruins and archæological remains generally, and thus, besides being a happy hunting ground of the mountaineer, appeals to a wide circle of residents and holiday-makers. In this way a quantity of fine residential property sprung up at various points along the railway, but more especially at Irton Road and Eskdale Green, where the scenery is of an exceptionally fine character —open, but with a mountain background in all directions. The building of this property, together with the needs of the villages along the route, resulted in the creation of a good traffic in coal and stores up the valley, balancing the carriage of ore in the opposite direction.

Unfortunately, towards the close of the last decade, the increasing use of basic iron ores in iron and steel manufacture resulted in a reduced demand for hematite ore, and

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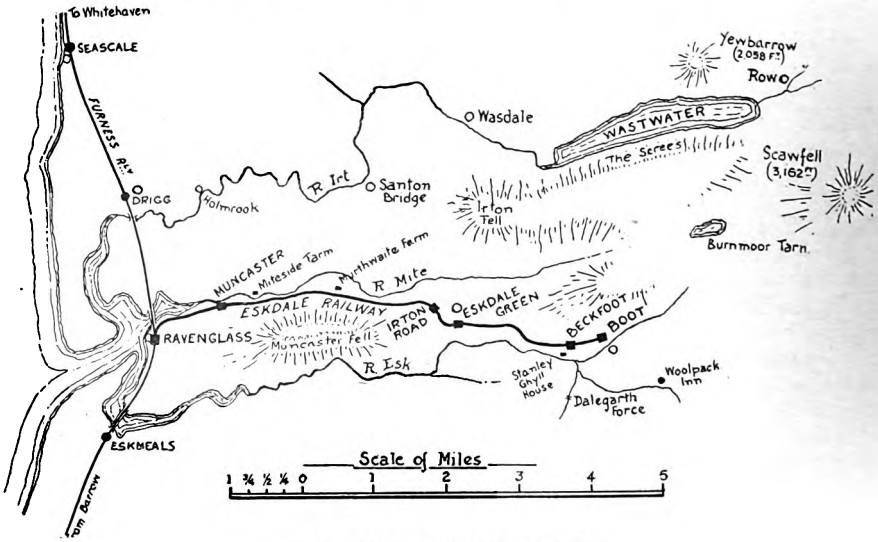
the mines at Boot, which could no longer be worked profitably, were consequently closed down. With the chief source of revenue withdrawn, the railway did not long survive. It ceased to convey passengers in 1908, and was for a time after that in the hands of a receiver and manager, who continued for some years to run goods trains to meet the urgent needs of the adjacent villages in the matter of railway communication. But finally, in consequence of the need arising for heavy repairs and renewals to the track, the line was closed altogether in 1913, and has since remained derelict. The result of this was to empty much of the residential property along the line, to close the fine Stanley Ghyll Hotel, which had been erected adjacent to Beckfoot station, and to greatly diminish the number of visitors to the valley. During the present year, however, a new era in the history of the Eskdale Railway has commenced, while at the same time a most interesting experiment has been inaugurated. For a small private company known as the Narrow Gauge Railways, Limited, of London, which laid down and worked for some time the well-known miniature railway in the Marine Park at Rhyl, in addition to similar lines at Geneva, Switzerland, and at the Christiania (Norway) Exhibition of 1914, has obtained a lease of the Eskdale Railway, and is now engaged in converting the gauge from 2 ft. 9 in. to 1 ft. 3 in. in order that the scale model express locomotives and rolling stock of these lines may be utilized. Pleasure railways of this character are, of course, quite familiar in exhibition grounds and parks, both public and private, but this is the first time that so narrow a gauge has ever been employed upon a continuous public railway in the open country. The Eskdale Railway is now, indeed, quite entitled to look upon itself as the smallest business railway in the world!

Before referring to the equipment, it may be of interest to make a "tour" of the line. The station at Ravenglass is adjacent to that of the Furness Railway, and consists of a capacious timber building, with a booking office, manager's office, and a large store-room for railway equipment of various kinds. There is a single platform, and the roof of the station building is extended over this and over the adjacent line of rails to a screen in front of the station, thus furnishing efficient protection from the weather. Between the station and the Furness Company's sidings a narrow-gauge siding has been laid to facilitate transhipment of goods, etc., from the full-sized into the miniature wagons, and also to allow for the storage of vehicles. Ample room is left for the laying of further sidings when necessary. Leaving Ravenglass Station the Eskdale Railway crosses the main road from Ravenglass inland by means of a steel girder bridge, and then passes the engine shed on the right. The latter is a brick structure with more than sufficient accommodation for the two 2ft. 9 in. gauge



PLAN OF THE ESKDALE RAILWAY.

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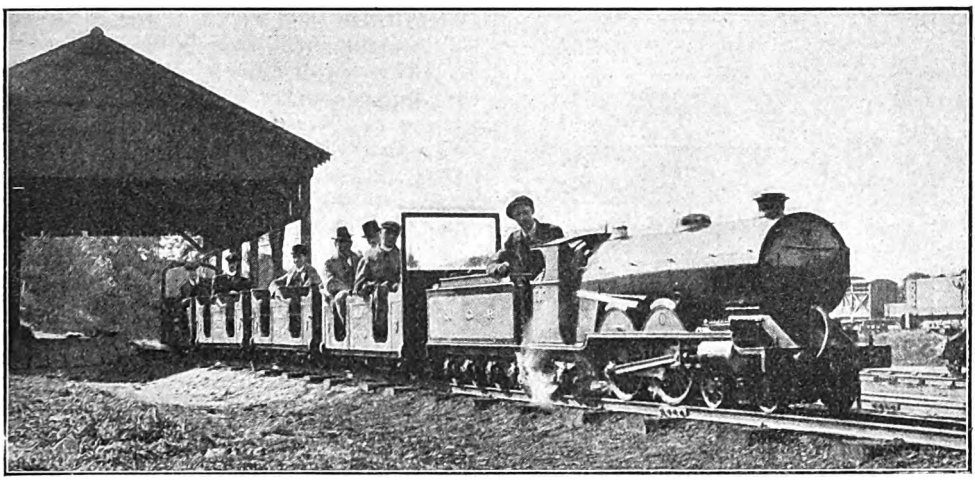
tank engines that were employed on the old line, so that three or even four roads of the narrower gauge can be laid in it if desirable. Shortly beyond this point a trailing junction was effected with the branch that was laid alongside, but on a higher level than the original line, into the Furness Railway goods yard, where the iron ore brought down from Boot was dropped through the bottom of hopper wagons direct into the large trucks. For the present, however, this line will not be used save for the storage of old rolling stock, and the junction has been taken out, From here the railway falls rapidly to the side of the River Mite—here an open estuary—the gradient averaging 1 in 50 for 3 chains, and 1 in 104 for 13 chains further.

At this stage it may be well to make a brief geographical explanation, in view of the fact that for more than half its course the Eskdale Railway is really not in Eskdale. The lower portion of the latter lies rather to the south of Ravenglass, and all the north side of the river forms the estate attached to Muncaster Castle, the residence of Lord Muncaster, now chairman of the Furness Railway. But the Eskdale Railway takes a more direct course up the valley of the River Mite as far as Irton Road, skirting on the north side the irregular rocky ridge known as Muncaster Fell, which rises from the surrounding plain to a height of 760 ft., and separates the valleys of the Irt and Mite from that of the Esk. As previously mentioned, the Eskdale Railway drops from Ravenglass station, which is 36 ft. above sea-level, to Muncaster, 1⅛ miles out of Ravenglass and the lowest point on the line; it is indeed, only 17 ft. above the sea. From here there is an almost continuous rise for 3 miles to Irton Road station, where the line is 127 ft. above sea-level. After leaving Irton Road, the railway turns towards the south-west, bearing round the end of Muncaster Fell and down into Eskdale, which is reached at the next station—Eskdale Green. This is ¾ mile beyond Irton Road, but 24 ft. lower in altitude. From Eskdale Green there are rising switchback grades along the side of Eskdale Fell as far as Beckfoot, 1⅝ miles further on and 148 ft. above the sea, but the last ⅝ mile into Boot forms a most toilsome ascent, the height of the terminus above sea-level being as much as 211 ft. The total length of the line is 7 miles, 8 chains. Of engineering features there are none, as the railway was laid practically over the surface of the ground, and the gradients in parts are therefore exceedingly severe. From Beckfoot to Boot 16 chains at 1 in 67 are followed by ¼ mile at 1 in 37, and a further 5 chains at 1 in 46. The descent from Irton Road into Eskdale is for 21 chains at 1 in 78, and another 13 at 1 in 81. Again, the climb from Muncaster to Irton Road includes 1¼ miles steeper than 1 in 100, with short stretches at 1 in 35, 40, 50 and 55. For a scale model locomotive this is, therefore, a very difficult road.



NARROW GAUGE TRAIN LEAVING RAVENGLASS.
The train is made up of the open "summer" rolling stock.

Resuming our journey from the side of the Mite estuary, from which a magnificent

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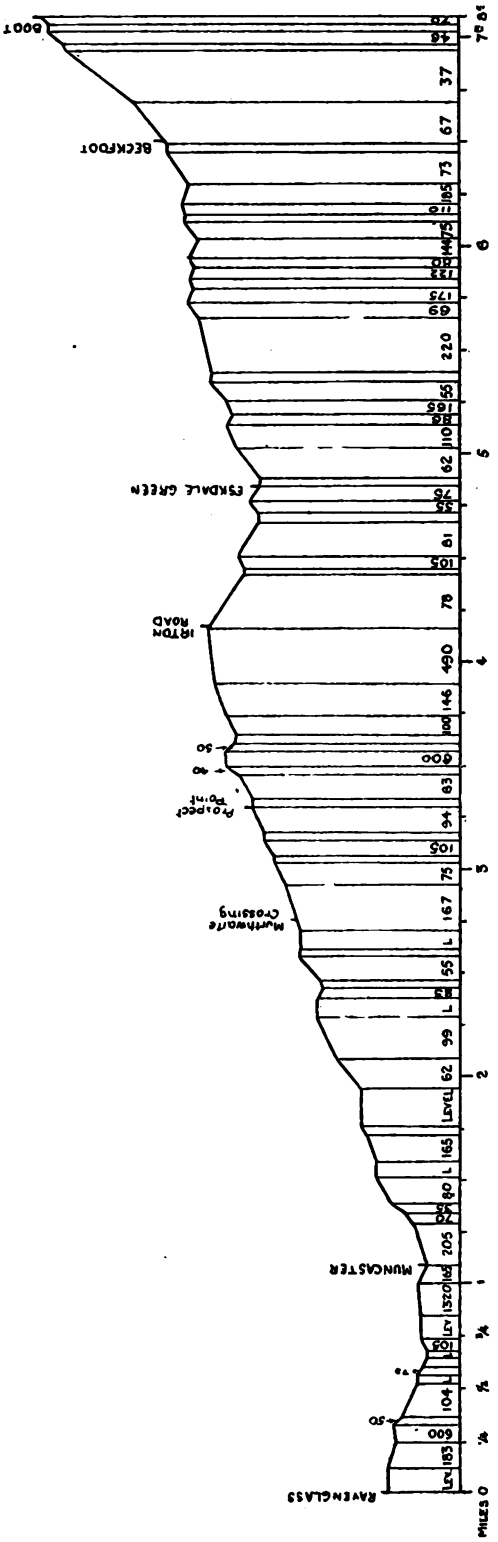

GRADIENT PROFILE, ESKDALE RAILWAY: RAVENGLASS TO BOOT.

view of the Cumbrian mountain chain is obtained, dominated by the giant head of Scawfell, we pass under a small accommodation bridge, and then under a substantial stone arch carrying the main road from Whitehaven to Barrow. Immediately beyond this is Muncaster station, adjacent to Muncaster Mill and at the foot of the steep slope of Muncaster Fell. Proceeding from here we rise rapidly over the mill-stream and through a plantation on to open moorland. The inland mountain panorama along this stretch is particularly fine, and the effect is accentuated by the abrupt character of the fell on the right, along which the railway is carried. About 3¼ miles from Ravenglass, and just after the line has attained a level of 100 ft. above the sea, we pass round quite a precipitous shoulder, with the river immediately below, and this has been christened "Prospect Point." Shortly beyond here we leave the side of Muncaster Fell and strike across open country to Irton Road station, passing *en route* under an accommodation bridge, and also by a stone bridge adjacent to the station under the by-road from Irton Road into Eskdale. After leaving Irton Road, as previously mentioned, the line bears round and drops into Eskdale, skirting all the way the grounds of various large houses that help to compose the scattered village of Eskdale Green. At Eskdale Green station we pass under the main road from Whitehaven and Gosforth to Boot and Ambleside, and from there we skirt on the left Eskdale Fell, the line rising by sharp switchback grades, and making various sinuous bends round the hillside that call for a very moderate speed on the part of the train. Approaching Beckfoot, we notice on the right the handsome building that was at one time the Stanley Ghyll Hotel, with its magnificent grounds; this has since been taken over by the Co-operative Holiday Association, and as one of their holiday centres now attracts a large number of visitors—mostly young people—throughout the summer. Beckfoot and Boot are, of course, splendid centres for pedestrian excursions in all directions, Wastwater and Scawfell, for example, being within easy reach, while such beautiful spots as Stanley Ghyll and Dalegarth Force are within half-an-hour's walk. The climb up the open hillside from Beckfoot to Boot has already been spoken of, and this portion of the line was planned rather to meet the convenience of the ore traffic than that of Boot village, which lies some distance below the station.

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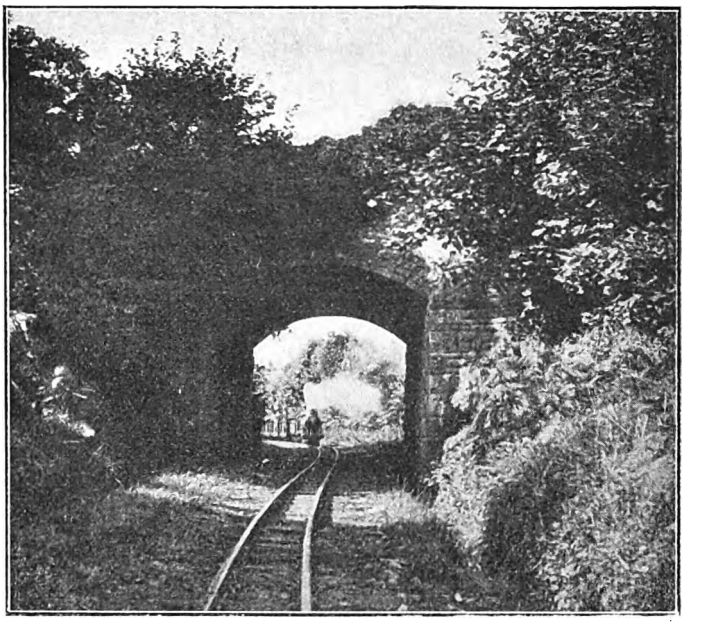
Other than Ravenglass, there are therefore five stations—Muncaster, Irton Road, Eskdale Green, Beckfoot and Boot. These are all quite unpretentious in character, each consisting of a short platform with a stone face adjacent to the line, and a neat timber or brick shed, partitioned into waiting room and booking office. At various other points on the line, however, such as Murthwaite Crossing, passengers will be set down or picked up when required, and in these cases it is proposed to erect hand operated signals in order that prospective passengers may be able to signal the trains to stop. Siding accommodation will be provided at most of the stations, but passing loops will not yet be installed, as for the present it is not intended to work more than one engine in steam on the line at one time. In order to enable the engine to turn at the end of each journey, and so always to run chimney first, turntables will be provided at Ravenglass, Irton Road, and Beckfoot or Boot. As regards other engineering details, there is the one underline girder bridge, at Ravenglass, together with sixteen small culverts or "cattle creeps" at various points, generally consisting of longitudinal baulks of timber as rail-bearers on stone supports. Of overline bridges there are seven, four of which have stone buttresses with a timber superstructure, carrying accommodation farm roads, whereas the remaining three carry public roads, and are substantial stone arches. No public roads cross the line on the level, although there are a number of accommodation crossings in different places. The alteration of the gauge and the renewal of the track generally has been no light task, as at many points the line was completely overgrown, and had first almost to be excavated. As far as possible, the original permanent way has been used, although the old wrought-iron flat-bottomed rails largely employed on the line were all so worn and laminated as to be useless. Elsewhere, however, the rails were of a good 40 lbs. per yard steel section, very little worn, and these are being re-laid to the new gauge, incidentally presenting a very curious appearance when dog-spiked only 15 in. apart. It has been found necessary to renew many of the fishplates and almost all the sleepers, the latter now consisting mainly of ordinary railway sleepers cut into three parts. It will thus be seen that the track is of quite exceptional strength and durability for the light loads that it will have to carry.



A PICTURESQUE VIEW NEAR MUNCASTER, SHOWING APPROACHING NARROW-GAUGE TRAIN.

The rolling stock, however, is the principal feature of interest, and the major part of this, together with other details of equipment, has been supplied by the well-known firm of Bassett-Lowke, Limited, of London and Northampton. At present only one locomotive is in use, this being of the manufacturers' "Sanspareil" or 30 class. It is built to a scale of 3 in. to the foot, and has the 4–4–2 wheel arrangement, with the following dimensions:—cylinders $4\frac{1}{8}$ in. bore by 6 in. stroke; driving wheels, 20 in. and bogie and trailing wheels $9\frac{1}{2}$ in. diameter; boiler, 19 in. diameter, containing 41 fire-tubes and pressed to 130 lbs. per square inch. A bogie tender is provided, containing seating room for the driver, and has capacity for a small quantity of coke for firing, with 50 galls. of water. Among the fittings may be noted the makers' gridiron type of smoke-box superheater, mechanical lubrication to cylinders, and an ingenious form

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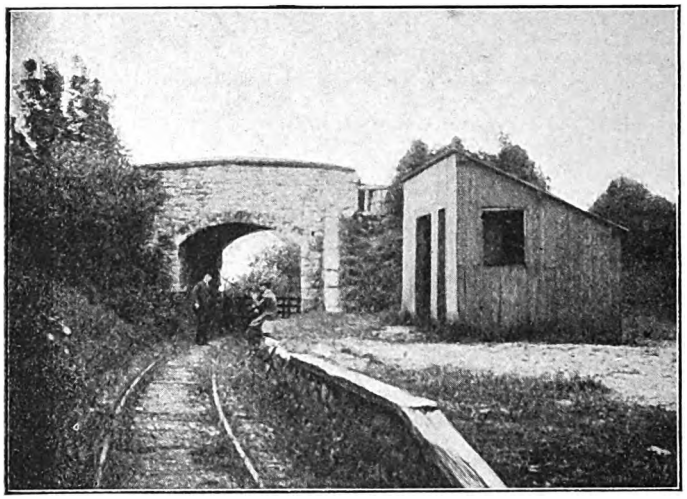

ESKDALE GREEN STATION AND OVER-LINE BRIDGE.
Before the reconstruction.

of vacuum brake. Overall the engine and tender measure 16 ft. 4 in., while the height from rail to the top of the chimney is 3 ft. 7 in.; the weight of engine and tender in working order is about 2¼ tons. This engine, it may be interesting to note, was the one in use at the Christiania Exhibition of last year, and is exactly similar to the locomotive built for Sir Robert Walker's private railway at Sand Hutton, Yorks, described in the RAILWAY MAGAZINE of February, 1914. It has now been thoroughly overhauled and painted a royal blue colour. A maximum speed of about 30 miles per hour can be realised by these engines on a level road, when moderately loaded, but in view of the heavy grades, it is anticipated that the complete journey to Boot, inclusive of stops, will occupy about 30 to 35 min. On the steepest part of the ascent from Muncaster to Ravenglass it is found that the present engine can tackle about 40 passengers, so that during the summer season additional locomotive power will probably be required. It has not yet been decided whether this shall take the form of a 4–6–2 engine similar to that built by Messrs. Bassett-Lowke for Mr. J. E. P. Howey's Staughton Manor Railway, or whether one of Sir Arthur Heywood's locomotives of the Duffield Bank Railway shall be purchased. These are more of a contractor's type, both six-coupled and eight-coupled tank locomotives of considerable power being available, and such engines would doubtless prove useful for working goods traffic, especially if the ore mines at Boot were to be re-opened. The locomotives of the original railway, by the way, were of a six-coupled tank type having 16 in. by 20 in. cylinders, so that the contrast in tractive power between past and present is very striking.

Passenger vehicles are varied in character. Messrs. Bassett-Lowke have supplied seven open coaches, each seating eight persons, two abreast, in two compartments. These coaches are specially designed with a low centre of gravity, to prevent unsteadiness in riding, or overturning when the engine is running at speed, and each weighs about 8 cwt. empty. They are handsomely panelled in varnished teak, and are provided with glass wind-screens, and also awnings for use in wet or very hot weather. The carriages are lettered "Eskdale Express" in raised brass letters. In addition to these, for winter service, a bogie passenger coach, 19 ft. 6 in. long, and a bogie brake-van, 15 ft. long, have been purchased from Sir Arthur Heywood. The former seats 16 persons, 12 in the body of the coach in three compartments, two passengers abreast, and an additional 4 on end platforms, and weighs 24 cwt. empty. Four passengers are accommodated on the end platforms of the brake-van, which has also ample space for light luggage. Each coach is fitted with combined central buffers and couplings, and equipped with the vacuum brake. The whole train of nine vehicles seats 76 persons, but this number is, of course, considerably in excess of the maximum number that is likely to be conveyed per trip during the winter months. Several small wagons, of 1 ton capacity, complete the present equipment of the line. For next summer great developments are promised. It is even hinted that a tea-car may be pressed into service, and teas served on the journey to and from Boot, which would, I think, fairly well exhaust the possibilities of a 15 in. gauge, and a one-quarter full-size scale!

Slower progress with the reconstruction has been made than was anticipated, mainly owing to the shortage of sleepers and labour, but the line should be open over its more

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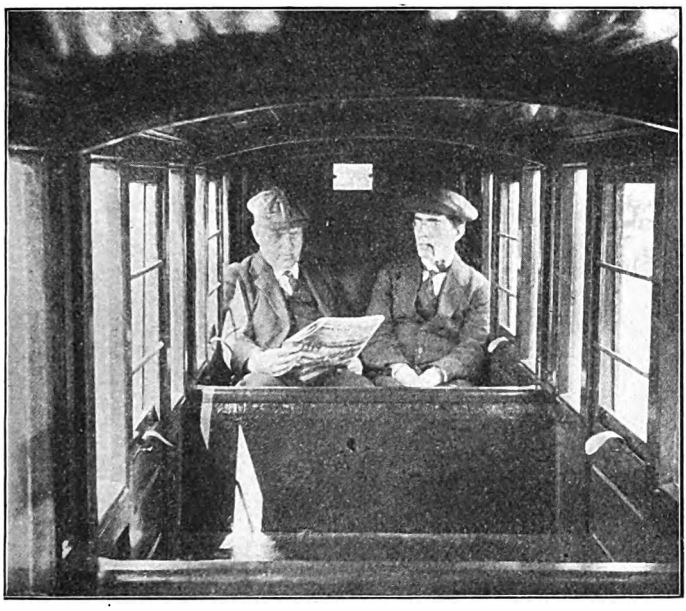

INTERIOR OF THE BOGIE PASSENGER COACH.

important stage—from Ravenglass to Irton Road—before the end of the year. Certainly but little time was lost by Messrs. The Narrow Gauge Railways, Limited, from the date of obtaining the lease. This took place in the middle of June last; a fortnight later the work had commenced and seven weeks after that passengers were being conveyed as far as Muncaster, the first station. So great was the novelty of the miniature equipment, that from midday on the Saturday of opening until midday on the following Wednesday 700 passengers from various districts round had taken a return trip on the line. The fare charged for the 2¼ miles to Muncaster and back is only 4d., which is, of course, but slightly above the ordinary penny-a-mile rate. In the spring of next year it is hoped to complete the reconstruction to Eskdale Green and Beckfoot, but it has not yet been definitely decided whether the concluding length to Boot shall be operated or not, on account of its exceedingly heavy grade, and also the fact that Boot station lies high above the village, and a considerable distance from the main road. The latter, however, runs right past Beckfoot station, which is almost as convenient of access to Boot residents as Boot station itself. Mr. John Wills, the general manager of the line, held a similar position on the Geneva Railway previously mentioned, and has had considerable experience of miniature railway work, having acted for some time as Messrs. Bassett-Lowke's London manager. His office is at Ravenglass. The Narrow Gauge Railways, Limited, are to be congratulated on this novel extension of their sphere of operations, and I am sure that every reader of the RAILWAY MAGAZINE will wish their enterprise the success that it deserves.

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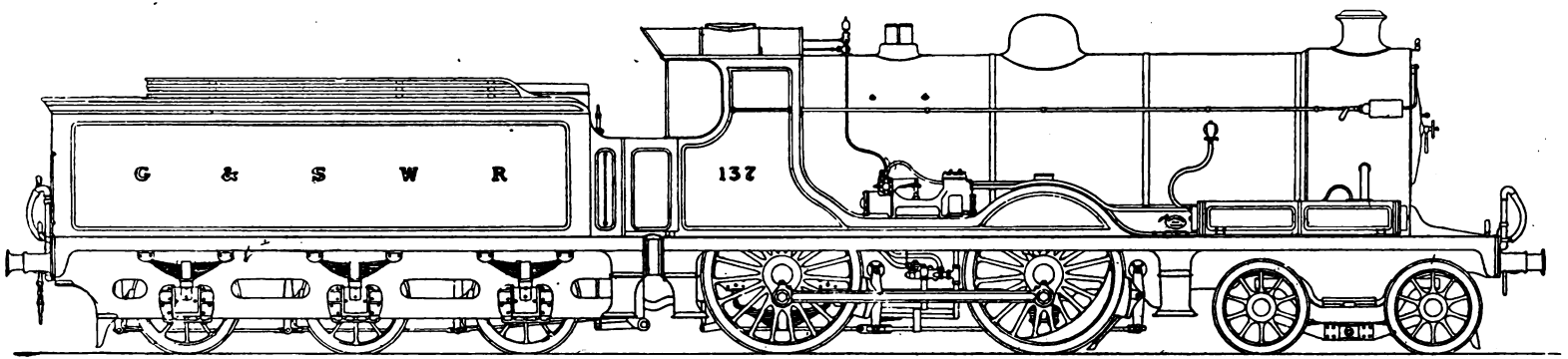
NEW 4-4-0 EXPRESS LOCOMOTIVES; GLASGOW AND SOUTH WESTERN RAILWAY.

Fitted with Schmidt Superheater and Weir Feedwater Heater and Pump.

Designed by Mr. P. Drummond: Locomotive, Carriage and Wagon Superintendent.



BY the courtesy of Mr. P. Drummond, Locomotive Superintendent, Glasgow and South Western Railway, we are able to illustrate one of a new series of 4-4-0 express engines built at the railway works at Kilmarnock. General design corresponds to earlier engines of this class, built in 1913, but whereas the original class were intended more particularly for the steeply-graded Greenock route and for the Ayr main line services, the new engines are used for the Carlisle-Glasgow main line.

Several changes of a detail character are involved. The smoke-box is lengthened by about 12 in. The Weir feed-water pump and heater are located on the footplate, with hot water injectors placed between the driving wheels. The engines are also fitted with Schmidt superheaters and Wakefield lubricators. Inside Walschaert valve gear is employed.

LEADING DIMENSIONS.

Cylinders	19½ in. by 26 in.
Wheels—Driving, diameter	6 ft.
Bogie, „	3 ft. 6 in.
Heating surfaces—Tubes, 5 in. diameter	357·41 sq. ft.
„ 1¾ in. „	1,086·59 sq. ft.
Firebox	148·0 sq. ft.
	1,592·00 sq. ft.

Superheating surface	330·61 sq. ft.
Total heating surface	1,922·61 sq. ft.
Grate area	27·6 sq. ft.
Working pressure	180 lb. per sq. in.
Total weight, engine and tender in working order	109 tons 5 cwt.

The six engines of this class are numbered 137, 138, 139, 140, 151 and 152.

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British Railway Officers in War Service. [No. IV.]

WITH so many railwaymen serving with His Majesty's fighting forces it is only to be expected that a considerable number of awards should go to men who have hitherto been engaged in working our iron roads. Many of these have been referred to in these pages, and further information is continually coming to hand. Indeed, nearly every large railway claims for its men a few such awards, though it follows that as certain railways have principally contributed to particular regiments, there have been opportunities for meritorious action in some instances which have not occurred in others.

Several railways have issued posters directing public attention to distinctions earned by their own men, and we may refer to one recently published by the Lancashire and Yorkshire Railway. The principal items are as follows:—

E. C. Simpson, Captain, Military Forwarding Officer (Assistant, Antwerp Agency) Awarded the Military Cross in recognition of special services rendered in connection with the Military Forwarding Establishment in France.

J. Barker, Private, 1st East Lancashire Regiment (Engineer's Department, Blackburn), awarded Distinguished Conduct Medal for conspicuous gallantry, ability, and general good work on numerous occasions, especially at Le Gheer on 17th January, 1915, in voluntarily assisting another man in extinguishing a fire caused by German shells. This work was accomplished in full view of the enemy, under heavy rifle, machine-gun, and shell fire. He was previously employed in erecting wire entanglements every evening, 80 yards from the enemy.

C. Brownlow, Corpl., 1st East Yorkshire Regiment (Chief Goods Manager's Department, Leeds) awarded Distinguished Conduct Medal for gallantry in the Field.

ASSISTANT-PAYMASTER D. M. GRACIE, R.N.R., GREAT CENTRAL RAILWAY.

R. Casey, Private, Lancashire Fusiliers (Chief Goods Manager's Department, Radcliffe) awarded Distinguished Conduct Medal for conspicuous gallantry on 4th June, 1915, during an action south of Krithia, Gallipoli Peninsula.

T. Hayes, Private, 2nd Yorkshire Regiment (Carriage and Wagon Department, Sowerby Bridge) awarded Distinguished Conduct Medal for gallant conduct on many occasions in conveying messages whilst exposed to heavy fire.

G. E. Stockham, Private, Royal Naval Auxiliary Sick Berth Reserve, Plymouth Batt. (Carriage and Wagon

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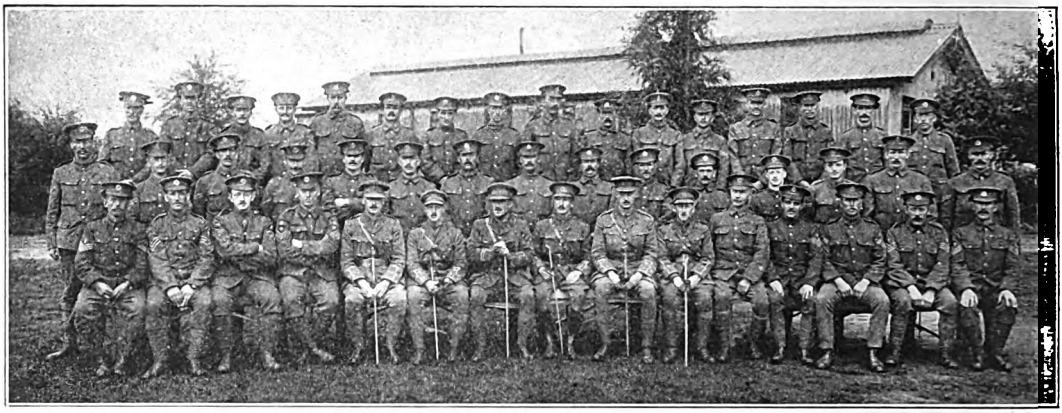

COMMISSIONED AND NON-COMMISSIONED OFFICERS OF THE 115TH (RAILWAY COMPANY), R.E., RAISED BY THE LONDON AND NORTH WESTERN RAILWAY.

Department, Bolton) awarded Distinguished Service Medal in recognition of his services with the Mediterranean Expeditionary Force. (Private Stockham unfortunately died of wounds received in the Dardanelles).

E. Walch, Staff Sergeant, Royal Naval Auxiliary Sick Berth Reserve (Chief Goods Manager's Department, Bolton) awarded Distinguished Service Medal for conspicuous service whilst in command of the Ambulance Section of the Naval Brigade during the bombardment of Antwerp.

It is pointed out that on this railway the departmental contributions to October 7th are as follows :—

Department.	Number of men.	Percentage.
Chief Goods Manager ..	1,825	18·38
Supt. of the Line ..	1,030	12·03
Chief Civil Engineer ..	587	13·42
Locomotive	1,872	17·67
Carriage and Wagon ..	565	18·34
Other Departments ..	429	33·54
Total	6,308	16·68

Reference may also be made to some new Great Western statistics now available. The number of men who had joined the Colours up to October 11th was 14,352. This represents over 18 per cent. of the entire staff of the railway. The percentage in the several departments of the Company's organisation varies considerably, the highest being over 63 in the Marine and Docks Department, owing to many of the employees having been taken into the service of the Admiralty. The next highest percentage is in the Audit Department, from which nearly 30 per cent. of the staff have joined His Majesty's Forces. The Locomotive, Carriage and Wagon Department has released 21 per cent. of its staff, the Goods Department 16 per cent., the Passenger Department 14 per cent., the Engineering Department 18 per cent., and the Signal Department 15 per cent.

Members of the Company's staff are among the fighting forces on land and sea in practically every quarter where the war prevails, and the records which have come to hand

COMMISSIONED AND NON-COMMISSIONED OFFICERS OF THE 116TH COMPANY R.E. RAILWAY TROOPS (GREAT WESTERN RAILWAY).

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from time to time of deeds of heroism and endurance on their part and, alas! of many casualties among them, show quite plainly that they are sharing in no small degree the brunt and the glory of the campaign. At the time of writing 303 men have been killed in action or have died of wounds; fifty-one others are missing; while 598 have been reported wounded, sick and prisoners of war, making the total number of casualties 952.

Mr. H. C. King, Assistant to Mr. G. J. Churchward, Locomotive, Carriage and Wagon Superintendent, Great Western Railway, has been transferred to the Ministry of Munitions. Both Mr. King's sons are at the front. The elder, Lieut. W. E. King, resigned his position as an Assistant Locomotive Superintendent on the North Western State Railway, India, as soon as the war broke out, and obtained a commission in the Artillery, and is serving in France. The younger, Mr. Aubrey King, is a trooper in the 2nd Australian Light Horse at the Dardanelles. Both served their times in the Swindon works.

Photo] [*Fred. Spalding & Sons, Chelmsford.*

LIEUT.-COLONEL H. M. WILLIAMS.

Assistant Superintendent (Outdoor), Carriage Department, Wolverton, London and North Western Railway. At present commanding 2nd Buckinghamshire Battalion, Oxfordshire and Buckinghamshire Light Infantry.

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Several additions to the list of London and North Western Railway men holding Commissions may be noted. *Permanent Way Department*:—A. J. Conway, Pupil, Crewe, Lieut., 6th Cheshire Regiment; E. L. Ferrier, Draughtsman, Bangor, 2nd Lieut., 3/6th Batt. Royal Welsh Fusiliers; R. H. Heape, Pupil, Crewe, 2nd Lieut., 5th Royal Fusiliers; P. Carnelly, Draughtsman, Edge Hill, 2nd Lieut., 10th King's Liverpool (Scottish); and H. K. S. Woodhouse, Draughtsman, Crewe, Promoted from Capt. to Major, 5th King's Liverpool Regiment. *Traffic Department*:—C. W. Webb, Clerk, Abergavenny, D.T.S.O., Lieut., King's Shropshire Light Infantry. *Goods Department*:—T. A. Moffet, Probationer, Waterloo, Lieut., 10th King's Liverpool (Scottish) Regiment temporarily attached to the Railway Operating Division, R.E.).

We omitted to mention last month that we were indebted to the Editor of the *Great Central Railway Journal* for the interesting illustration reproduced on page 396 and showing a group of Great Central railwaymen in France. We are also indebted to our contemporary for the portrait of Assistant-Paymaster D. M. Gracie reproduced herewith. A few further items relating to the Great Central Railway may here be noted. Corporal P. Pell-Ilderton, Queen's Westminster Rifles (Chief Engineer's Office), who has been at the front since November last year, has been granted a Commission in the 7th Manchester Regiment. Corporal S. C. Saward, 1st London Division Royal Engineers (Chief Engineer's Office), has been gazetted Second Lieutenant to his present Corps for services in the field. Lieut. Saward has gained rapid promotion since he joined the forces at the outbreak of war. He joined as Sapper in August last year, and was made Lance-Corporal in September of the same year; Second Corporal in November when his Division left for the front, and Full Corporal while in France in February this year. He was gazetted Second-Lieutenant on the 8th September while still abroad in recognition of meritorious service in the field; a further honour being that he is attached to his old Company. Lieut. Saward is the son of the London Cartage Manager. Mr. E. A. Walters (Chief Engineer's Office) has been granted a Commission in the Kent Fortress Royal Engineers. Assistant Paymaster D. McAuley Gracie, R.N.R., was gazetted on the 17th August last for Naval transport work at Grimsby Docks. Mr. Gracie is a member of the Higher Grade Staff and possesses a knowledge of navigation and shipping, which renders him peculiarly fitted for the work which he has undertaken.

Mr. J. B. Pearson, who recently resigned the position of head of the outside machinery section of the Chief Mechanical Engineer's Department, North Eastern Railway, to become General Manager to Messrs. Cowans, Sheldon & Co., Carlisle, has been appointed, with the consent of his firm, Assistant Superintendent of the Royal Laboratory at Woolwich Arsenal for the period of the war. He took up his duties on October 25th.

Several other North Eastern appointments may also be noted. Mr. A. C. Crone, of Tyne Dock, has been gazetted 2nd Lieutenant in the York and Lancaster Regiment. Mr. Crone commenced as telegraph clerk at Tyne Dock and afterwards served as booking clerk at Choppington and other places. At the outbreak of war, he enlisted in the 18th Hussars (Queen Mary's Own) and became, successively, corporal and sergeant. Afterwards, he was for a time with the 3rd Hampshire Regiment.

Mr. T. Lishman (Divisional Goods Manager's Office, Newcastle), has received a commission in the 5th Northumberland Fusiliers (T.). Mr. Lishman served in the Northumberland Hussars (I.Y.) from 1901 to 1907, and joined the National Reserve in 1910. He was called up for service in September, 1914, and attached to No. 2 Supernumerary Company, 5th Northumberland Fusiliers, for guard duty under Tyne defences. He was promoted to the rank of Lance-Corporal in November, 1914, and became Corporal in February, 1915. In July this year he was recommended for a commission and was gazetted on August 6th, 1915.

Mr. George Herbert, of York, who received a commission during the first months of the war, has now been made Captain in the A.S.C. Mr. N. W. Reed (goods clerk, Bolton Percy), 10th East Yorks, has been promoted to the rank of 2nd Lieutenant in his own regiment. Mr. H. O. Johnson (Chief Engineer's Office, York), who held the rank of Sergeant in the North Eastern Railway Pioneers, has received a commission as 2nd Lieutenant in the 3/5 Northumberland Fusiliers. Mr. J. W. Whisker (Engineer's Accounts Office, York), formerly Sergeant 5th West Yorks (T.), and more recently Company Sergeant-Major in the West Riding Divisional Cyclist Corps, has now received a commission as 2nd Lieutenant in the latter corps. Mr. R. H. Thompson (District Goods Agent's Office,

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York), who became Sergeant in the R.A.M.C., has received a commission as 2nd Lieutenant in the 7th Northumberland Fusiliers (T.).

Other members of the North Eastern Railway staff who have received commissions are :—Mr. L. Ballan (traffic apprentice), 2nd Lieutenant 24th Manchester Regiment; Mr. W. R. Tate (goods clerk), Wetherby, 2nd Lieutenant, 12th Royal Warwicks; Mr. P. H. Quickfall (C.G.M.O., York), 2nd Lieutenant, 5th Durham Light Infantry (T.); Mr. J. N. Hanagan (draughtsman, Outside Machinery Section, Chief Mechanical Engineer's Department), Lieutenant, Army Ordnance Corps. The total number of North Eastern Railway commissioned officers is now 103.

Mr. W. Marriott, Resident Engineer to the Midland and Great Northern Joint Railway, has two sons serving and will shortly have three. Mr. R. E. Marriott, B.Sc., of the P.W.D., Lucknow, is in the Indian Army Reserve as Second Lieutenant, Royal Engineers, attached to Queen Victoria's Own 2nd Sappers and Miners. Mr. Marriott was for a time, before going to India, under Mr. H. Fowler at Derby. Mr. F. K. Marriott, M.R.C.S., L.R.C.P., has been gazetted Temporary Hon. Lieut. R.A.M.C., and is *pro tem* on duty at the London Hospital. Mr. Marriott's eldest son, Dr. W. A. Layard Marriott, M.B., Ch.B., is one of eight or nine doctors in Norwich who are arranging for their practices and joining the R.A.M.C.

Mr. A. E. Tattersall, Signalling Assistant to the Engineer, Metropolitan Railway, has obtained a commission (1st Lieutenant) in the Army Ordnance Department.

Some interesting particulars of the career of Major Lyle, of the Locomotive Department, London and South Western Railway, are given in the November issue of the staff magazine. At the outbreak of war Major Lyle was employed at Southampton Docks, but was granted a commission on November 4th, 1914, as captain in the 1st East Lancs Divisional Supply Column, and commanded same until the men were absorbed into the Regular Army Service Corps (Mechanical) Transport. On the departure of the above he was appointed Senior Supply Officer, and in March of the present year was advanced to his majorate, when he thereupon took over the duties of the Senior Supply Officer of the 2/1st East Lancashire Division. Among Major Lyle's many duties there he is responsible for the victualling of 13,500 men daily from six supply depôts, extending over an area of 60 miles.

We are sorry to learn that Lieut. John Alexander Ross, 17th London Regiment, second son of Mr. Alexander Ross, late Chief Engineer, Great Northern Railway, was recently killed in action in France. The deceased officer, who was in his 34th year, was formerly in the solicitor's department, Great Northern Railway, and received his commission in February last.

Lieut. Allan Wilson of the Great Eastern Railway Civil Engineering Department, died of pneumonia following on an attack of appendicitis, on August 25th, 1915, while serving with the Royal Engineers in France. He entered the service in the Engineer's Department (New Works) in 1906, and was subsequently employed at Parkeston during the construction of the Quay extension. On its completion he was transferred to Cambridge (February, 1910), where he remained until he joined the Colours in October, 1914.

Mr. Arthur William Hall, of the department of the Chief Mechanical Engineer, has died of enteric fever whilst serving at the Dardanelles as Sixth Engineer on board H.M.S. *Reliance*. Mr. Hall was born on May 8th, 1893, and on March 14th, 1910, commenced a five years' term of apprenticeship at Stratford. Passing through the usual stages of the training, he was afterwards placed on the staff of the Chemical Laboratory and also spent a few months at the Running Sheds. He joined the Royal Naval Transport Service on May 22nd of the present year and died on September 11th. Mr. Hall was an Associate Member of the Institution of Civil Engineers. Whilst at Stratford, he was successful in winning many prizes and certificates in connection with the classes at the Company's technical institute, and in 1913 obtained a special prize for securing the second highest progressive result for the session. In the same year he also won a scholarship offered by the West Ham Borough Council.

By the courtesy of the Editors of our London and North Western and Great Western contempories, we are able to reproduce group photographs showing the commissioned and non-commissioned officers of the 115th and 116th Companys, R.E., Railway Troops, formed respectively by the London and North Western and Great Western Railways.

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From Salisbury to Cape Town by Road.

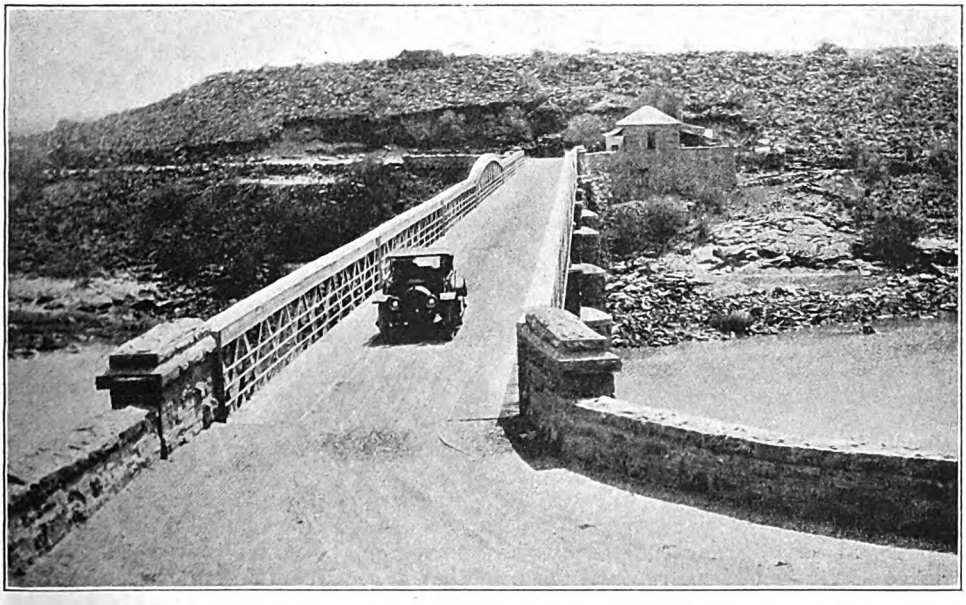
AN EXCEPTIONAL MOTOR CAR PERFORMANCE.

IN the September RAILWAY MAGAZINE, under the general heading of "Railways and Kindred Industries," the important part which is being filled by the motor road vehicle was emphasised, not merely as an alternative to, but largely in association with the railways; and in "pioneer" countries, such as South Africa, parts of South America, India, etc., the motor car counts for still more, seeing that distances are great, and railways and train services relatively limited, the possibilities of correlation of rail and road transport being still wider.

One of the chief requisites in such application is that road motor equipment shall be designed and constructed with particular reference to the conditions involved, to meet severe geographical difficulties, to attain a high standard of reliability, and to allow for climatic and other adverse influences, all these requirements being frequently of a nature such as is unknown in more highly developed countries, with well-made roads, repair and garage facilities available at least every 30 or 40 miles, and a railway usually within about the same distance or less should it become quite impracticable to continue a journey for the time being.

Apart from their general pleasure and commercial work, therefore, firms such as D. Napier & Son, Ltd., have developed a large trade in motor road vehicles designed specially with a view to their use under the more arduous conditions of colonial travel, and as showing what more difficult journeys of the character suggested may entail, and the standard of reliability attained by these cars, the following particulars of an exceptional run by a Napier car, claimed to be one of the most remarkable ever accomplished, will be of interest.

It was undertaken and carried through by Mr. A. C. Henderson, of Mazoe, Rhodesia



CROSSING THE FAMOUS BARKLEY WEST BRIDGE OVER THE VAAL RIVER—THE BOUNDARY BETWEEN THE TRANSVAAL AND THE ORANGE FREE STATE.

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a well-known member of the Scottish community of Salisbury, Mr. R. B. Mitchell accompanying him.

They left Salisbury on September 1st, and broke all records by getting into Cape Town on Friday, September 24th. The distance covered was 1,953 miles, and no car has previously been able to complete the journey A large part of the way was entirely trackless, and at such points the help of native guides had to be obtained, or the car steered as nearly as possible to the compass. It can be imagined that many exciting moments were experienced by the intrepid driver and passenger, and it is nothing short of marvellous that a car has at last succeeded in doing this journey.

(8 of which were spent in Johannesburg) originated in a semi-serious suggestion of mine in my club at Salisbury. It was enthusiastically seconded by my fellow traveller-to-be, Mr. R. B. Mitchell, and accordingly we decided to leave in two days' time and endeavour to accomplish this record run.

Naturally, beyond renewing the tyre covers and general oiling up, there was no time to do anything else to the car, which left for the trip practically untouched, and having already over 10,000 miles to its credit over the roughest roads in Rhodesia. The betting was at long odds against the successful completion of the contemplated trip.

IN THE DRY BED OF THE RIVER INSIZO, NEAR WEST NICHOLSON, RHODESIA.

It may be mentioned that Mr. Henderson imported this car—an extra strong Colonial Napier—nearly three years ago, and it was not tuned up in any way for this arduous task, the whole trip being arranged hurriedly. The run occasioned great interest in South Africa.

A careful log of the journey was kept, the principal events being covered by the following description of the run, written by Mr. Henderson himself.

The idea of this trip, which has now been successfully completed in 23 days' time

The start was made from Salisbury at 3 p.m. on September 1st, but the last good-byes were said at Beatreace, to which point the Napier was accompanied by a party of motorists. From here the road to Enkeldoorn furnished next morning a foretaste of much that was to follow. Heavy sand necessitated a great deal of second-gear travelling, but such good time was made that a car which started two days earlier reached Enkeldoorn only as many hours ahead. To Umvuma, where the second night was spent, an average 10 miles per hour only was maintained, but in the morning

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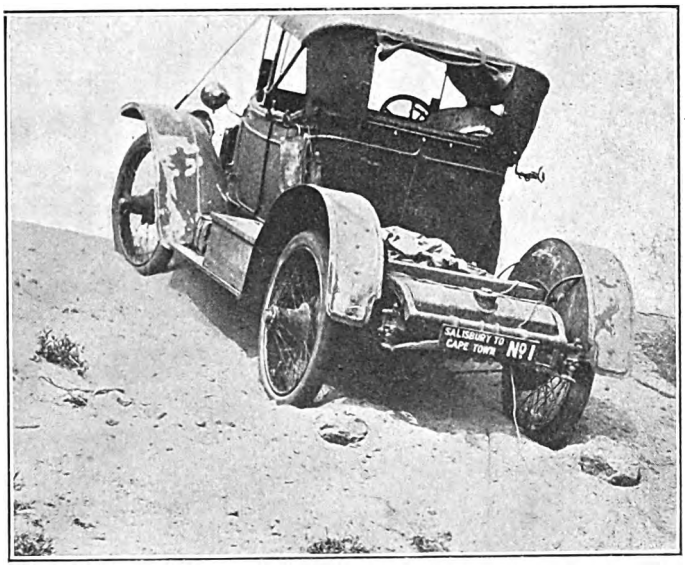
this was increased to 18 miles per hour on the fairly good road from there to Gwelo. The day's run finished at Shangani, which was reached at 5.30 p.m.

At 1 p.m. on the 4th, the Napier was at Filibusi, and at Balaballa in another hour. The fourth night was spent on the veldt, and in the morning a native was requisitioned as guide, there being no defined road at Gwanda. Balaballa to Gwanda (45 miles) was covered at an average of 7½ miles per hour. West Nicholson was the next stop, and here the fifth night was spent. Musunga, the homestead of the Liebig estate, was reached in five hours next morning at an average 12 miles per hour; and at 7 p.m. (from 3.30) the same evening the Limpopo River, 40 miles ahead. Next morning, with the assistance of a team of donkeys, the river was crossed 3 miles lower down. The afternoon was spent at Messina in oiling the car.



ON THE SOUTHERN BANK OF THE LIMPOPO RIVER.

Leaving Messina at 6 a.m., six hours were occupied in reaching Louis Trichardt, 60 miles distant, the Sand River proving a serious obstacle; but from here to Pietersburg, 24 miles per hour was averaged over the best bit of road found on the trip. The night was spent at Potgietersrust, reached in 3½ hours from Pietersburg. The 8th day out started at 6 a.m. and at 1 p.m. the Napier was in Pretoria (141 miles), and the 36 miles to Johannesburg took another 90 minutes. The total distance covered in the 8 days was 853 miles, and with the exception of a broken fan belt no mechanical trouble had been experienced.

Eight days were spent in Johannesburg, and a start again made on Friday afternoon the 17th. The night was spent at Potchefstroom. Next day, the 122 miles to Bloemhof took 6 hours. Just over 14 miles per hour was averaged to Fourteen Streams where the night was spent at the railway station. From 7.30 a.m. Kimberley (69 miles) was reached in 4½ hours *viâ* Barkly West, and in the afternoon the journey was continued to Belmont (60 miles) at 20 miles per hour. The 28 miles to Hopetown took 2 hours next morning, and starting again at 10, Britstown (90 miles) was reached at 3.

At Victoria West the night was spent on the veldt, and at 11 a.m. the Napier was at Beaufort West, the running time for the 88 miles being six hours. Leaving here the road to Fraserburg was taken in mistake for Fraserburg Road, and Sutherland was not reached till 4.30, the running time for the 153 miles being 8 hours. The night was spent at Matjesfontein, which was reached at 11.30, two hours having been spent on the road in resting and tyre repairs. Wellington was the last night's stop, and Cape Town was reached in two hours on the morning of the 24th.

I drove throughout the trip, the running time for the total distance covered (1,953 miles) being 126 hours. The running time from Johannesburg to Cape Town was 61 hours, beating all previous records by 6 hours. Petrol consumption averaged 18 miles per gallon, the total quantity used being 108 gallons. Both the car and ourselves came well through the strenuous journey, feeling none the worse. The Dunlops on the rear wheels were in excellent condition. We have to acknowledge many courtesies and kindnesses received *en route*.

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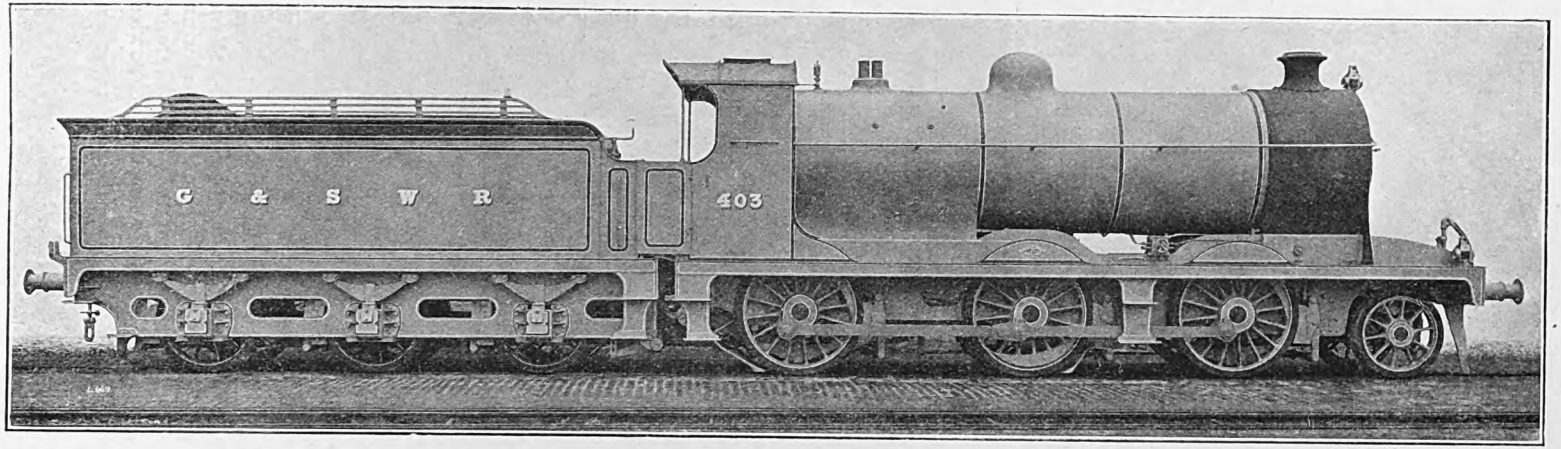
2-6-0 SUPERHEATER LOCOMOTIVE; GLASGOW AND SOUTH WESTERN RAILWAY.

Designed by Mr. P. Drummond: Locomotive, Carriage and Wagon Superintendent.



HITHERTO the 2–6–0 type has only been used, as regards modern designs, by the Great Northern, Great Western, London, Brighton and South Coast, Caledonian, and Great Southern and Western Railways, but it has now found favour on a second Scottish railway, at the hands of Mr. P. Drummond, Locomotive Superintendent, Glasgow and South Western Railway. One of these engines, as built by the North British Locomotive Co., Ltd., is illustrated, and the design includes Schmidt superheating apparatus, piston valves, and link motion with rocking lever transmission.

Leading Dimensions.

Cylinders	19½ in. by 26 in.
Leading wheels	3 ft. 6 in. dia.
Coupled wheels	5 ft. dia.
Wheelbase—Rigid	17 ft. 1 in.
,, Total	23 ft. 7 in.
Steam pressure	180 lb. per sq. in.
Heating surface—Tubes	1,344 sq. ft.
,, ,, Firebox	147 ,,
Total	1,491 ,,
Superheater	211 ,,
Total	1,702 ,,
Firegrate area	26·25 sq. ft.
Weight in working order	62 tons
,, on coupled wheels	54 tons 7 cwt.
Tender wheels	4 ft. dia.
,, wheelbase	13 ft.
,, tank capacity	3,970 gallons
,, fuel space	270 cubic ft.
,, weight, full	45 tons 19 cwt
Wheelbase, total, engine and tender	46 ft. 7 in.

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Ambulance Trains for Continental Service.

IN previous numbers the RAILWAY MAGAZINE has described all the hospital trains hitherto built by home railway companies for service in France, and now we deal with the last of the series, that built by the London, Brighton and South Coast Railway, ambulance train No. 25. This train, intended for service in France, was exhibited at principal stations as follows: Brighton, November 4th; Worthing, November 5th; Portsmouth, November 6th; Brighton, November 7th; Hastings, November 8th; Eastbourne, November 9th; London Bridge, November 10th; Victoria, November 11th and 12th.

A charge of 1s. (except at Portsmouth, 6d.) was made for each person inspecting the train, the money collected being devoted to the fund for providing comforts for the Railway Troops (R.E.) serving with the Expeditionary Force, the railway men not being covered by any other fund.

Vehicles on view were: one brake van, with accommodation for stores; one kitchen car, with cupboards, etc., for cooks, steward's stores, etc.; one ward car, for lying-down cases, containing 36 cots; one pharmacy car, containing all necessary fittings for medical appliances, and treatment room equipped with operating table, etc.; one staff car, with quarters for medical officers and nurses, for night and day; one sitting-up car, to accommodate 64 cases; one sitting-up car for a similar number of infectious cases; one personnel car, for the use of orderlies, with sleeping accommodation for 28; one brake van, with separate wards for infectious cases.

Comprised in the complete train of 16 bogie coaches are two kitchen cars, a pharmacy car, four ward cars, five sitting-up cars (one for infectious cases), a staff car, a personnel car, and two brake vans. The exterior of the train is painted khaki colour, with a large Red Cross on a white background painted in the centre of each car on either side. The four ward cars contain 144 beds, which are fitted in tiers of three, and as the coaches have elliptical roofs, ample air space is given. In the five sitting-up cars one finds accommodation for 320 cases, one car with 64 places being set apart for infectious cases; this car has no upholstery, the seats being of perforated three-ply wood.

Each kitchen car is furnished with a special army range, fitted with a circulating hot-water apparatus with a capacity of 50 gallons of hot water per hour, supplied by the London Warming and Ventilation Company. Water is obtained from two large roof tanks with a capacity of 150 gallons each, which enables an ample supply of hot and cold water to be available. The pharmacy car has a treatment room, an office, one linen room, a medical store, and is fitted with an urn and sterilisers, so that if needed an operation may be performed on the train.

Medical officers and nurses use the staff car, which is self-heated by the Dargue-Griffiths system. The personnel car provides accommodation for 28 persons, and is similarly self-heated. One brake van has one large and one small store, the other is fitted with two infectious wards, one for six and the other for 12 cases, in addition to the guard's compartment.

The coaches measure 54 and 55 ft. long by 8 ft. 6 in. wide, the whole length of the train being 930 ft. 8 in. over buffers, and weighs 429 tons. Steam heated and electrically lighted throughout, the train was built at the Brighton Company's Carriage Works at Lancing under the supervision of Mr. A. H. Panter, the carriage and wagon superintendent.

It may be mentioned that Railway Troops (R.E.) have been raised by the Railway Executive Committee for various duties with the Expeditionary Force in France in connection with work under the Director of Railway Transport. The total number of officers and men who have joined the Corps up to the time of writing is 4,950.

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Railway Engineering and Equipment.

Water for Locomotive Feed Purposes.

THERE is probably no boiler which, in order to work efficiently, requires better water than the locomotive boiler. In this type scale forms very rapidly owing to the rapidity with which evaporation takes place. The locomotive boiler is also liable to prime, a difficulty which is largely caused by matter in suspension either existing as mud originally in the water or produced from a clear water by the hardening salts being thrown out of solution as the boiling point is reached. The effect of suspended matter in water can be readily observed by taking two beakers, filled say half full, with distilled water, and by introducing into one of the beakers some matter insoluble in water, such as finely divided clay. If these two beakers are now placed on a hot plate it will be noticed that whereas the clear distilled water will boil quite calmly, the water containing the clayey matter in suspension will "bump" considerably, and probably cause some of the water to be thrown over the top of the beaker. This is exactly what takes place in a boiler when it primes.

The formation of scale produced from a hard feed water not only considerably reduces the evaporative capacity of a locomotive boiler and causes enormous amount of loss in time and money spent in cleaning, but it also produces considerable strains due to over-heating of the fire tubes, due to the high resistance to passage of heat from the fire to the water which the scale offers.

Rankine gives the following table of resistance to passage of heat of various substances:

Wrought Iron	1·0
Copper	3·4
Slate	9·5
Brick	16·7
Calcium Carbonate	17·0
Calcium Sulphate	41·0

It will thus be seen that where copper tubes are used in locomotive boilers, should a scale of calcium sulphate equal to the thickness of the tube be formed, the tubes will offer nearly 14 times as much resistance to the passage of heat as if the tubes were clean, as they should be if soft water were used. Not only are considerable losses in fuel and boiler cleaning caused by the use of hard water for boiler feed, but also an enormous amount of repairs are necessitated annually by corrosion produced by water possessing corrosive properties due to various salts contained in solution.

Practically all the troubles caused by hard and corrosive waters may be eliminated by the installation of efficient water softening plants at various points on the line where hard or corrosive waters exist. When one considers the enormous number of places in the United Kingdom where hard water is being used for locomotive purposes it is extraordinary that so little attention, comparatively, has been paid to the water softening problem by British railways.

The Kennicott Water Softener Company, Wolverhampton, has specialised very largely in the softening and purification of waters for locomotive purposes, and this firm's softeners are to be found at work on practically all the most important railway systems throughout the world.

It may be of interest, in order to show the advantages gained by the use of softened water, to take as an example a big railway where softeners have been installed systematically. On the Union Pacific Railway, United States of America, the Kennicott Water Softener Company has installed plants throughout the system, and the table below is of interest showing the reduction of flue and fire box failures due to the installation of Kennicott softeners.

On the Nebraska Division washouts were reduced from 856 to 240 per month. Over the entire system the average number of miles between washouts was formerly 300, while it is now between 1,100 and 1,200.

On the Union Pacific Railway the Kennicott Water Softener Company has 37 plants in operation, with a total capacity of 10,000,000 gallons of water per day, removing therefrom over three tons of scale-forming matter. The Kennicott

Division.	Flue Failures.		Fire Box Failures.	
	July 1st, 1902, to June 30th, 1903.	July 1st, 1903, to June 30th, 1904.	July 1st, 1902, to June 30th, 1903.	July 1st, 1903, to June 30th, 1904.
Nebraska	817	107	1,339	357
Wyoming	474	43	1,003	92
Kansas	23	25	113	88
Colorado	96	35	342	50
Total	1,410	210	2,797	587
	85·2%	Reduction.	79·0%	Reduction.

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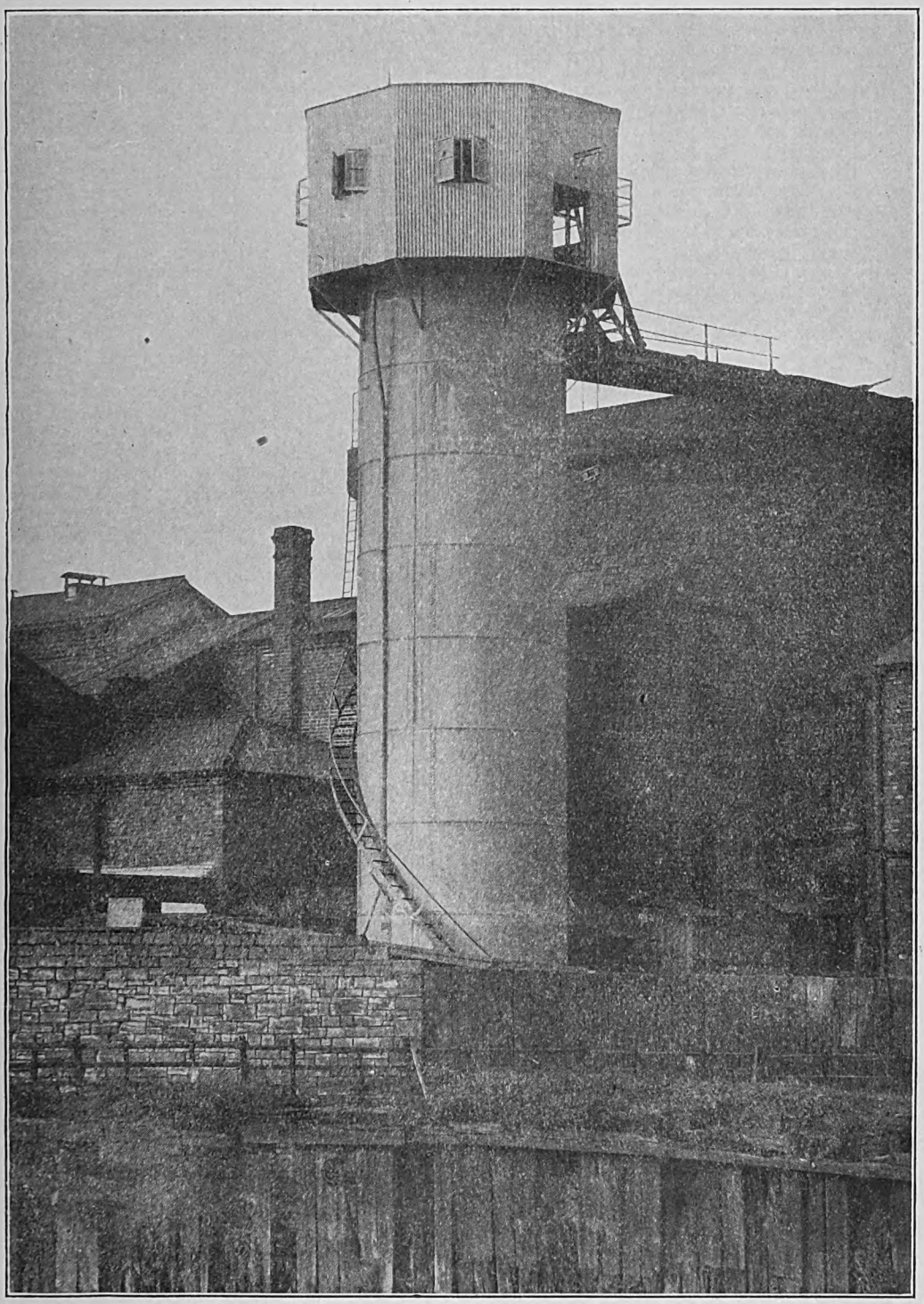

480,000 GALLONS PER DAY KENNICOTT TYPE "K" SOFTENER. MEXBOROUGH ENGINE SHEDS: GREAT CENTRAL RAILWAY.

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Water Softener Company has lately put on the market an entirely new type of water softener known as the Kennicott Type "K." This plant has practically revolutionised water softening. One of this latest type machines of 20,000 gallons per hour capacity was installed about two years ago on the Great Central Railway to treat very bad scale-forming and corrosive water at Mexborough with most excellent results, and the Great Central Railway Company is now having a plant of the same type of 15,000 gallons per hour capacity installed at Immingham Dock.

Space will not permit of detailed description of the working of the present Kennicott standard plant, but the makers will be pleased to send full particulars to railway officers and others to whom the subject appeals.

The following are among the principal installations carried out for British home railways:

Railway.	Location.	Capacity, gals. per hour.
Great Western ..	Severn Tunnel ..	30,000
,, ..	Aldermaston ..	10,000
Hull and Barnsley ..	Cudworth ..	10,000
,, ..	Carlton	10,000
,, ..	Wrangbrook ..	10,000
Great Central ..	Mexborough ..	20,000
,, ..	Immingham ..	15,000
London and North Western	Stonebridge Park (2)	2,500
Londonderry & Lough Swilly	Burtonport ..	500
North British ..	Methil	6,000

In addition the following Colonial and foreign railways (other than American) are equipped with Kennicott plants: New South Wales Government, South Australian Government, Western Australian Government, Imperial Chinese, Natal Government, Rhodesian, Benguela, South African Government, South Indian, Central of Peru, El-Paso North Eastern, United of Yucatan, French Metropolitan, Central Asiatic, Russia, besides several in various Continental countries. There are, of course, considerable numbers in the United States, where water softening appears to have received more general attention.

A New Fencing for Railways.

No one who has travelled on the Continent can have failed to have noticed the apparently frail-looking fencing alongside the lines of many of the important railways in France. In comparison with the heavy quartering fencing largely used at home, it appears ridiculously weak, but, as a matter of fact, closer investigation will show that far from this being the case, it is not only immensely strong, but, being practically unclimbable, forms a far better protection than our more solid-looking and expensive barriers. This fencing is composed of cleft chestnut wood pales bound together with quadruple strands of galvanised wire. It has been found eminently practicable on French railways, where it has been utilised for many years with the greatest success.

Although this type of fencing has been used for some time past in this country by large estate owners, Corporations, and the like, it appears strange that our railways have not hitherto employed it to anything like the extent which its merits deserve. It is manufactured in this country under the registered title of "Chespale" fencing, by Messrs. Cardon & Co., Ltd., of 61, 62, Chancery Lane, London, W.C., at their works at Penshurst, Kent, in the heart of the chestnut growing district. This enterprising firm is now introducing it to our leading lines, and we understand that many important orders have already been booked, amongst others from the London and North Western Railway, and the Great Northern Railway of Ireland.

The peculiar sinuous nature of the chestnut wood pales, which are hand-riven, not sawn, make it exceedingly tough, whilst the ease with which it is erected together with its lowness of cost renders it a proposition worthy of the serious consideration of all who have this particular part of railway works under their control, more especially so in these times when the advanced costs of practically all other fencing materials causes one "seriously to think." The makers urge that "Chespale" is a thoroughly dependable substitute for the more commonly recognised fencings, and state that the regular twist of the quadruple galvanised strands, a vital point only obtainable by their patent machinery, in conjunction with the hand-riven pales, gives permanency to the fence and makes it a sound investment.

Messrs. Cardon & Co. issue an illustrated catalogue depicting the various styles in which it is manufactured, a copy of which they will be happy to send to anyone interested.

America and Railway Supplies for the Allies.

THAT the United States stand to gain a great deal because of the inability of belligerent nations to deal with ordinary trade and manufacture, while these nations are themselves requiring material on an enormous scale and to an unprecedented degree, is clearly shown by the large orders which American locomotive building firms are executing on behalf of our allies. In August we gave particulars of 100 articulated locomotives supplied by the Baldwin Locomotive Works to the French Government. Details may now be given of other notable orders executed by this and other firms in the United States, and to some extent also in Canada. For use in Russia the Baldwin Locomotive Works have supplied 250 2–10–0 locomotives, 100 other engines of the same class being built by the American Locomotive Company, and 50 by the Canadian Locomotive Company, making 400 in all. These orders were placed during the latter part of June, and the first engines were ready for shipment soon after the middle of August. This period included designing, the builders having considerable latitude in regard to utilising American standard parts—possibly supplied from stock to some

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extent—as far as they could be incorporated while meeting the specified conditions and requirements, building, testing, and dismantling and packing for shipment. In general appearance the American Locomotive Company's engines correspond very closely to the Baldwin-built series, and in many respects the designs are actually interchangeable; but in certain details each builder has been allowed to adopt its own methods as far as they complied with the specification. Thus, the Baldwin engines have a special base for the safety valve and whistle; the American Locomotive Company's engines have these placed upon the main steam dome. The former have a straight mud ring; in the latter the ends slope towards the centre line. The Baldwin engines have Rushton reversing mechanism; the others have screw reversing gear, in both cases with air motors in the cab. Apart from the magnitude of the order, these engines are of interest because of their design and the urgency with which they have been constructed. Although the axle loads are light, the locomotives are of considerable capacity, as they exert a tractive force of 51,500 lbs.

Canadian-built Cars for European Service.

THE Russian Government has placed orders recently in Canada for a number of freight cars to be delivered on short notice. These include 2,000 steel-framed, inside-sheathed, 40-ton box cars for grain and general service, and these are now being delivered by the Eastern Car Company, New Glasgow, N.S. The type of construction embodies a design of outside metal roof with running-board and handrail attachments to suit European practice.

A structural steel side framing is employed. Door hangers operate on an enclosed track. Grain doors of the removable type are provided, and the usual type of steel threshold plate is secured over the flooring at the door opening. The flooring is formed by tongued and grooved boards bolted to the underframe members. The usual type of brake mast application, as used for cars operating in Canada is followed, and a pressed steel platform and brace is included. Hook type, drop forged couplings and European disc buffers are used. All safety appliances are arranged to come within the clearance gauge of the German and Austrian railways. An arch-bar type of truck is employed in conjunction with axles having journals for 100,000 lb. capacity cars, in spite of the fact that the cars are only built for 80,000 lb. loading.

The cars are shipped knocked down, the underframe all in one piece, with floor laid, and are routed to Vladivostok, where they will be assembled. The first vessel with 175 cars left on September 7th.

The British Government is having built by the National Steel Car Company at Hamilton, Ontario, for service in France and Belgium, 1,300 steel frame covered cars of the M. M. Nord type, largely used in Europe. One hundred of them are provided with accommodation at one end for a brakeman on guard.

The cars are mounted on four rolled steel wheels, 40 15-16 in. diameter on tread line, and forged steel axles.

In the case of the 100 special cars mentioned, the chief difference is in the accommodation for the brakeman. The brake gear is operated by hand only from one end to brake mast provided with a spiral worm. This actuates a series of levers, all wheels being equipped with two each, combined brake head and shoe. Both kinds of car are equipped with footboards below each side door opening, brackets for signals and lamps, end safety chains and suitable hooks and chains, etc., inside car for securing cattle or merchandise.

Small-tube Locomotive Superheater: Robinson Design.

THIS has been designed by Mr. J. G. Robinson, Chief Mechanical Engineer, Great Central Railway, for the purpose of overcoming difficulties experienced in the maintenance of boilers fitted with smoke-tube superheaters of well-known types, in which the superheating pipes are placed in a few tubes of much greater diameter than those usually fitted to locomotive boilers; and also to increase the evaporative and superheating efficiency.

It is found, more especially in districts where the feed-water supply contains a high percentage of incrustating salts, that trouble is experienced in keeping the large flue tubes tight in the firebox tubeplate, more particularly those tubes near the flange, where the unequal resistance of the copper tubeplate results in the tube holes becoming deformed, with consequent leakage. This deformation in time necessitates the holes being reamered out, and new ends brazed or welded to the old flue tubes. With smaller flue tubes, up to about 3 in. external diameter, there is no difficulty in keeping them tight in the tubeplate, and the deformation of the tube holes, due to the expansion and contraction, is minimised, and less skill is also required to satisfactorily secure these tubes in the tubeplate as compared with large flue tubes, 5 in. diameter, usually employed in connection with locomotive smoke-tube superheaters.

In this design the tubes containing the elements are very much smaller than those generally set apart for that purpose, and the whole of the tubes are made of the same diameter, one superheater return pipe being placed in each. In the usual design each tube contains four lengths of superheater pipe connected in series with each other, there being two sharp return bends within the tube at the firebox end and one at the smokebox end, the two free ends of the set of four pipes (or superheater element as it is called) being connected, one to the saturated and one to the superheated steam compartment of the header. There are, therefore, twice as many sharp return bends at the firebox end of the superheater pipes as there are tubes, and since the greater part of the superheat is taken up at the firebox ends, and more particularly at the bends, a satisfactory temperature is thereby attained.

With the large flue-tube type of superheater it is usual for only about half of the total products

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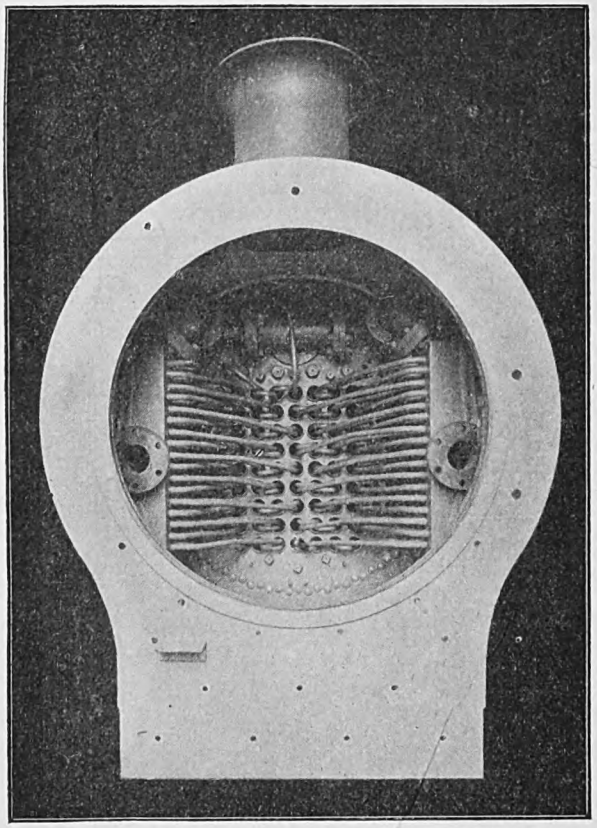

GENERAL VIEW SHOWING APPLICATION OF ROBINSON "SMALL-TUBE" SUPERHEATER.

of combustion to pass through the superheater flue tubes, where they are employed partly in evaporating steam and partly in superheating it. In the superheater under consideration the whole of the products of combustion pass over the superheating pipes, therefore the return bends of the superheater can be placed much further within the flue tubes, so that there is not the slightest risk of overheating them, whilst at the same time their length may be such that the working temperature of the superheated steam may be considerably higher if desired than can be reached with superheaters of the large flue-tube type.

With this type of superheater any element can be put in or removed without disturbing any other. There is also obtained a very high evaporative efficiency of the flue tubes on account of the retarder action of the superheater pipes, the amount of heat extracted from the products of combustion in the form of evaporation and superheat combined being very considerably more than would be absorbed as evaporation only by a similar boiler fitted with ordinary small tubes and without a superheat, though the tube heating surface of the latter boiler would be larger than the former.

It will be seen that the superheater pipes are expanded directly into the headers, and the pipe ends can readily be removed without damaging them, these operations being performed from the outside of the smokebox by removal of special covers. There are, therefore, no fastenings, such as studs, nuts, bridge bars, or copper joints, inside the smokebox—a very important feature.

The headers are secured to the smokebox plates by box form flanges, so that the studs and nuts securing the covers are not exposed to the smokebox gases, but are in recesses formed by the header flanges in the smokebox sides. These recesses are covered with curved plates, conforming to the contour of the smokebox, secured by a few screws. It is not necessary for steam or air-tight joints to be made by these curved plates.

For engines engaged in intermittent service, such as working suburban trains with very frequent stops at short distances apart, or for shunting, this type of superheater is particularly adapted, as owing to its large number of return bends at the hot ends of the tubes, and the fact that the whole of the firebox gases pass over the superheater, it very quickly builds up the steam temperature.

An engine fitted with a superheater of this type has been working both express and stopping passenger train services on the lines of the Great Central and Cheshire Lines Railways, giving a temperature of about 750 deg. Fahr. in the superheater, and with eminently satisfactory results.

The engine in question is one of an old class, which, as is not at all unusual in old engines, was very much under-boilered for its cylinder capacity, and was, in consequence, unable to work the Liverpool and Manchester express trains, which often consist of nine heavy bogie vehicles, to time. No alteration was made in the firebox, boiler shell, cylinders, or working pressure, but the opportunity offered by a firebox renewal was taken to replace the original 190 tubes $1\frac{3}{4}$ in. outside diameter by seventy-eight tubes 3 in. outside diameter, the superheating pipes 1 in. outside diameter lying in every tube.

It was found, as a result of this change, that instead of the engine power being limited by the steaming capacity of the boiler, the cylinders were now the limiting factor, as the boiler was able to produce with ease all the steam that they could use, and the engine, instead of only keeping time with great difficulty with a load of seven bogie coaches, can now do so with ease with a load of nine if required.

The monthly coal sheets over an extended period compared with those of sister engines without superheaters, working the same service,

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show savings varying from 18 per cent. to 22 per cent. The same engine has also been thoroughly tested on stopping train services with equally satisfactory results, the temperature of the steam varying very little from the maximum at any time.

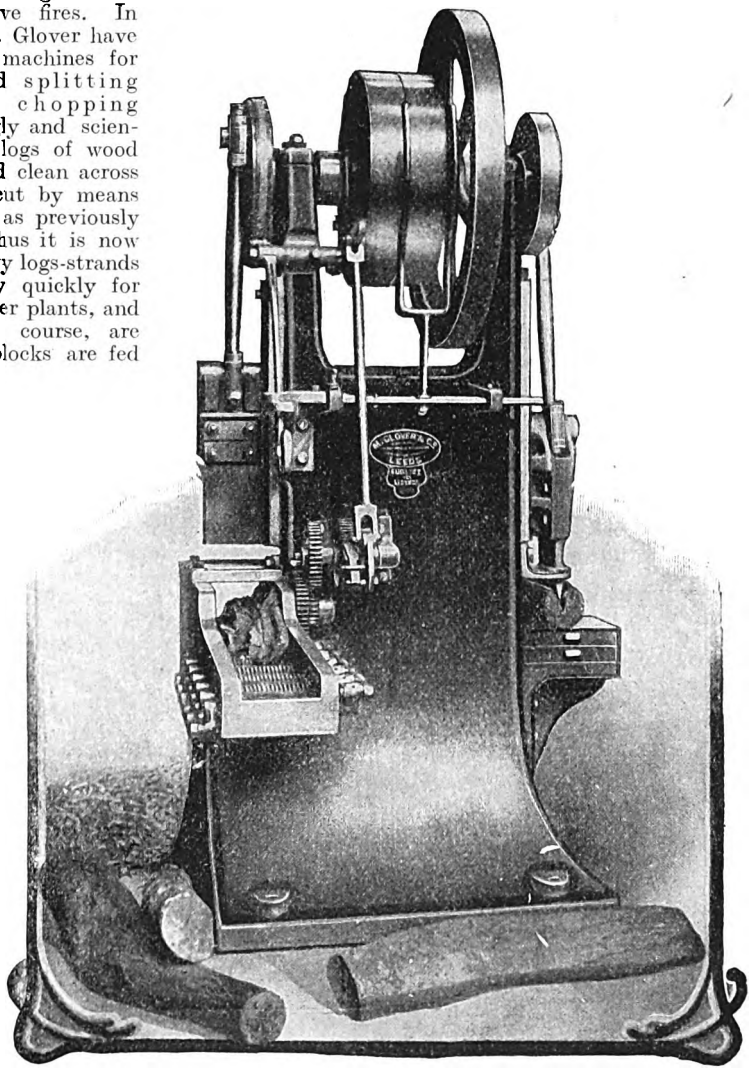
The apparatus has also been fitted to a Great Central Railway 8-coupled goods engine for trial purposes.

Wood Splitting Machines.

ATTENTION may be directed to Messrs. Glover's machines for chopping heavy wood, employed for providing fuel wood as used in locomotives for steam raising, and also for the lighting up of locomotive fires. In this department Messrs. Glover have made a speciality of machines for meeting heavier wood splitting requirements. Their chopping machines are so strongly and scientifically designed that logs of wood can actually be chopped clean across instead of being cross-cut by means of hand or power saws as previously has been necessary. Thus it is now possible to chop up heavy logs-strands into short lengths very quickly for feeding into gas producer plants, and far better results, of course, are obtained when short blocks are fed instead of long lengths such as are used when the cross-cutting has to be tediously and expensively done with saws. Messrs. M. Glover & Co., Sawmill Engineers, of Leeds, are likewise patentees of the well-known "Ideal" saw guard.

Upper Quadrant Signals.

HITHERTO "upper quadrant" signals have been exclusively employed on the Extension line of the Metropolitan Railway, the only other instance being the American "three-position" outside Paddington Station, Great Western Railway. Recently, however, several of the McKenzie, Holland, and Westinghouse Co.'s electrically - operated lower-quadrant signals on the Metropolitan "City" lines have been replaced by upper quadrant arms, equipped by the same firm, as at Aldgate and between Moorgate Street and Aldersgate Street Stations; while at Queen's Park they are used to control London Electric traffic. There is much to be said for the upper quadrant principle on local electric lines as, apart from other advantages, the operating motor is directly applied to the arm, and all transmission and balance weight levers and rodding are dispensed with; besides which a lower-power motor and lighter parts can be adopted.



GLOVER'S IMPROVED WOOD SPLITTING MACHINE.

Designed specially for meeting requirements in engine sheds (for lighting-up and steam-raising) and for other heavy purposes.

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The New Canadian Pacific Railway Station at Quebec.

THE foundation stone of the new station which the Canadian Pacific Railway is building at Quebec as a Union station, was laid by the Mayor of the city on August 12th. The building is designed in a modern adaptation of the chateaux of the Loire, France. It is being erected at the corner of St. Paul and Henderson Streets, and will have as a frontage a large open paved plaza, approximately 300 by 200 ft.. flanked on either side by broad sidewalks leading to the main entrance. Between the sidewalks and the building will be large spaces which will be planted with Lombardy poplars and blue spruce and other shrubs. The main building will be of Argenteuil granite, Deschambault limestone, and Citadel brick, with high sloping roof of copper. The main entrance, which will be from St. Paul Street, will be 25 ft. wide. Above it will be a window about 40 ft. in height, of metal sash divided into seven sections. At the crown of the arch will appear the arms of seven of the historic names of Quebec, *viz.*, Montmagny, who was the first Governor of Canada, from 1636 to 1647; DeTracy, Viceroy of Canada, 1665; Beauharnois, Governor of Canada, 1726 to 1747; Montcalm, one of the French Generals defending Quebec when the English conquered Canada in 1759; Wolfe, the general who led the English to victory on the Plains of Abraham in 1759, and died on the battlefield; Frontenac, Governor of Canada, 1672; Talon, first Intendant of New France, 1665 to 1672. The main façade of the building will be dominated by a central tower with turrets at the angles, at the bases of which will be cartouches, bearing in one case the fleur de lys of France, and at the other the Tudor rose, the thistle and the shamrock of the United Kingdom of Great Britain and Ireland. High upon the roof will be an ornamental clock with a dial 8 ft. in diameter, over which will appear the city's arms. The building will be L-shaped, the central block 175 ft. long, and wing 200 ft. long.

The station buildings.

At the entrance will be a lobby approximately 45 ft. by 65 ft. and 60 ft. high, to be entirely of tapestry brick with ornamental work in faience tile. The room will be lighted from the St. Paul Street side and also from the roof, the spaces in the roof being filled with ceiling lights. The central ceiling light will contain a cartoon in leaded glass showing the Dominion of Canada. with the thousands of miles of the Canadian Pacific Railroad dominating the industrial and prairie sections marked in distinct colourings. The ceiling of the dome will be constructed entirely of faience tile with ornamental patterns arabesque in blue, red and gold. The main cornice of the big lobby will also be in faience tile, and will carry a series of cartouches symbolic of the Canadian Pacific Railway, *viz.*, its hotel system, railways and steamships.

On the main floor will be ticket offices, baggage room, parcel room, customs offices, transfer. telegraph and news stand. From the vestibule a marble staircase will lead to the offices on the first floor, which will be occupied by the Canadian Pacific Railway, and space will also be provided for the accommodation of the National Transcontinental Railway. The main concourse will be 65 ft. by 125 ft. and 40 ft. high, constructed of tapestry brick with faience insertings in colour. All of the ornamental work in this room will carry the characteristic ornaments of the French Chateaux and Dolphin Tridents interspersed with the Tudor rose.

Opening off the concourse will be the station agent's room and the usual conveniences. Train gates will separate the concourse from the train shed, which will be on the same low principle as Windsor Street station in Montreal. There will be eleven tracks, and the platforms will be well lighted. In the concourse near the train gates electrically illuminated train indicators are to be installed.

January "Railway Magazine" will commence a new volume.

Frontispiece will be a colour reproduction of a

— magnificent oil painting illustrating a —

NORTH EASTERN RAILWAY TRAIN

travelling at full speed.

Price as usual, 6d. Order Early.

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The War and Railways.

UNDER this title Mr. Frederick W. West, Goods Superintendent for the London district of the South Eastern and Chatham Railway, contributed to *The Daily Telegraph* an interesting article from which we may quote.

Referring first to the reorganisation of the staff that was inevitable as the result of the large percentage of the experienced employés of all grades loyally responding to Lord Kitchener's call for "men and still more men," Mr. West points out that the railways could not engage men of military age to fill the gaps so created, and as others were available only in insufficient numbers, and as, moreover, the traffic was greater than ever and constantly increasing, they were faced by a problem indeed. A manufacturer or trader in such circumstances would be able to reduce his trading operations and undertakings to the level of his staff capacity, but not so the railways, as they must be still carried on, not only for military purposes, but for the maintenance of the commerce of the country, without which, of course, her power for prosecuting the war to a successful conclusion would greatly diminish. It happened that early in the course of events a number of Belgian refugees, including some formerly employed on Belgian railways, came along, and by engaging these the gap was partially stopped, but as they were unused to British railway methods and were handicapped by the language difficulty, they were by no means man for man equivalent to the men who had left, while numerically they fell far short of what was required.

Introduction of Female Labour.

THERE appeared to be only one course to adopt, continues Mr. West, and that was to take the revolutionary step of employing women in so far as they could be adapted to the duties, and, therefore, the experiment was tried. Well-educated young women, plenty of whom responded to the invitation to try their hands, were put into training for the clerical department, and to their credit be it said they quickly attained a sufficient measure of efficiency to be able to perform the lesser technical duties in the ratio of three females to two males. It would be unreasonable to expect either any young woman or any young man without previous experience adequately to replace men of experience in a business involving so much training and technical knowledge as the railway, consequently it was considered good, if not quite as economical, when it was found that three untrained girls could fairly undertake two trained men's duties. It seemed that what they lacked in experience they gained in enthusiasm, and there is no reason to doubt that if they apply themselves to the cult of the railway with the same pertinacity and thoroughness that they are showing at present, they will quickly become very proficient. Other women, perhaps better qualified by physique than education, were engaged to take the place of men as carriage cleaners. Then came the female ticket collector, who, of course, speaks for herself. Girl messengers in place of men have become quite the thing. There does not seem to be any good reason, except sentiment, if that be one, why women who are physically fit should not be employed extensively as porters and carters, is the decided opinion expressed by Mr. West. Indeed, he suggests their employment in many other capacities where the shortage of labour is felt, though so far they have not been experimented with in those directions to any appreciable extent.

General User of Locomotives and Rolling Stock under War Conditions.

ALTHOUGH there is, in no sense, general pooling of locomotives and rolling stock, one of the results of the administration of our railways under Government direction has been a much wider distribution of material, and not a few instances of the allocation of locomotives belonging to certain railways for use on others. In this way Hull and Barnsley engines have been used for some time on the South Eastern and Chatham Railway, as already noted, and we noticed recently some Hull and Barnsley goods brake vans carrying plates inscribed "For use on S.E. & C.R. only." We understand also that several Great Central Railway "Atlantics" and goods engines are working on the Caledonian main line, and it is now stated, in order to meet the heavy demands placed upon the Highland Railway, North British, Caledonian, North Eastern and London & North Western engines are being used on the system, whilst Great North of Scotland Railway four-coupled trailing bogie-tank No. 84 has been shunting at Invergordon. Through the scarcity of labour it has been necessary to send some of the Highland engines away to be repaired to Newcastle, Glasgow, and Kilmarnock firms.

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A Scottish Railway "Roll of Honour."

EVIDENCE as to the way in which Scottish railwaymen have rallied round, the Flag is to be found in the Roll of Honour of one of the principal Scottish companies—the Glasgow and South Western Railway. A photograph is reproduced on this page. The original is on view at St. Enoch station, Glasgow, and contains the names of upwards of 1,300 of the Company's employees who have joined His Majesty's Forces since the outbreak of the War. It measures 7 ft. deep by 3 ft. 6 in. wide, and is enclosed in a massive gilt frame. The mount carrying the names is of thick three-ply oak covered with the best English gold. At the head of the mount appears the Company's Coat of Arms, in colour, and immediately below is an oil painting, measuring 28 in. by 26 in., by Mr. Allan Davidson, the eminent painter.

This painting is described in a leaflet issued by the Glasgow and South Western Railway thus: "The principal figure in the painting represents the womanhood of the Empire, and expresses the silent admiration and love of women towards their defenders at the front. She holds unfading laurels, and records the splendid valour of the men on and beyond the seas, representatives of both branches of the Service being depicted in the picture amidst the smoke of battle."

Below the picture is the following inscription:—

FOR KING AND COUNTRY.

ROLL OF HONOUR.

NAMES OF STAFF EMPLOYED
BY THE
GLASGOW & SOUTH WESTERN
RAILWAY COMPANY.
WHO HAVE JOINED THE
COLOURS.

and then follow the names, which are engrossed in black and which are representative of all grades and every department in the Railway service.

At the commencement of the War the Glasgow and South Western Company employed 9,804 men, and up to the end of September 1,300 of these, or 13.25 per cent. of the total number employed had joined His Majesty's Forces. Of that number, no fewer than 22 have given their lives for their Country. Altogether the Roll is unique, and the designers are to be congratulated on the excellency of their work and those who have occasion to visit St. Enoch station should not miss the opportunity of seeing the tribute paid by the Glasgow and South Western Railway Company to their employés who have gone to fight for King and Country.

A GLASGOW AND SOUTH WESTERN RAILWAY "ROLL OF HONOUR."

Sugar Beet Culture on the London and South Western Railway.

TOWARDS the end of last year Sir Herbert Walker, General Manager, London and South Western Railway, with a view to the further development of the agricultural districts served by his line, gave special consideration to the question of sugar beet culture, and, on his initiative, meetings of farmers were arranged at the various agricultural centres at which experts on the question of Sugar Beet Culture gave information as to the prospects and possibilities of such crops, and Mr. W. Buckmaster and Mr. F. V. Milton, of the general manager's office, spoke as to the railway facilities and interest. This matter was referred to in the article on "The General Manager's Department of a Great Railway," which commenced our July number.

As a result of these steps some 40 agriculturists in Surrey, Hants, Dorset, and Devon decided

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to grow sugar beet, for which purpose arrangements were made by the Company for the supply of seed to the growers at cost price, also in regard to the purchase of this year's crops at prices ranging from 14s. to 27s. per ton for clean roots delivered to rail.

The *South-Western Railway Magazine* gives particulars of the development of the scheme and the results realised. The crops raised have proved conclusively that the soil and climate of the south-west counties are eminently suited for sugar beet culture. Most of the roots are being conveyed to Cantley, Norfolk, for the manufacture of beet sugar. In some instances, however, the farmers have preferred to keep the roots for cattle-feeding, etc. Considerable interest has been aroused by the experiment, and some hundreds of inquiries have been received by the Company's Publicity Department from all parts of the kingdom and abroad. It is highly probable that next year the number of growers in the south-west will be considerably increased, especially in view of the national importance of the Empire's sugar supply.

The Newark Accident.

Reporting upon the collision on September 6th at Newark, Great Northern Railway, between a passenger train and a truck, the 5.45 p.m. down express from King's Cross striking an empty wagon which had become derailed during shunting operations in the western sidings adjoining the down main line, just as the express was approaching the spot, Lt.-Col. Druitt states that "it is clear from Shunter Whittington's evidence that what occurred was, that when he shunted the last lot of ten or eleven wagons into No. 1 siding, he must have pushed back the seven already there until the southernmost one, a Great Central empty, was just foul of the connections leading from Nos. 2 and 3 sidings to No. 1 siding, and that when, some time later, and just before the accident occurred, he commenced to push the wagons forward in No. 3 siding, one of the leading ones must have hit the Great Central empty wagon a glancing blow, and turned it right over into the space between the down main line and No. 1 siding, and although this space was 10 ft. in width, one end of the wagon fell foul of the down main line. . . . Whittington should have satisfied himself by actual observation that this crossing was not fouled, and his failure to carry out rule No. 184 (c) was the immediate cause of the collision."

Fortunately the coaches kept more or less in line, and there was no telescoping, and the only fatality and most of the injuries were caused by the seventh coach turning over on its right side. The carriages were fitted with central buffers, and with automatic couplings known as the Gould Buckeye coupler. These couplings are very strong, and Lt.-Col. Druitt attributes the small damage done to the train, although derailed when running at a speed of from 60 to 70 miles an hour, to the strength of the couplings keeping the carriages connected together one behind the other in a more or less direct line, and preventing any tendency for one or more to get broadside on to the others, and for the underframe of one car to ride over that of the next one to it, resulting in one telescoping into another. In conclusion, the Inspector refers to the good arrangements made for quickly taking the injured to hospital after being attended to by a medical man who was travelling in the train, and also for sending the uninjured passengers forward to their destination. In respect of the last statement, the unusual condition arose in that Lt.-Col. Druitt is able to speak from personal experience, as he was a passenger in the train.

Train Working in the latter part of the 19th Century.

In reference to these articles, Mr. F. M. Mann, of Surbiton, writes as follows: "Like many others who have left their youth behind them I have been greatly pleased with Mr. Ahron's articles and the following experience by the late Mr. Rous Martin, which appeared in the *English Mechanic* some time in the late 80's, may be of interest in view of the Great Western articles now appearing. It appears Mr. Rous Martin was anxious to see for himself what difference the very gradual incline of the main line made to the down and up trains worked by the old 8-footers, and with that view obtained permission to journey down by the 11.45 to Swindon and return by the corresponding up train. An extra coach was put on at Paddington (not to the driver's satisfaction) and punctual to the minute they got away, Mr. Rous Martin explaining why he was making the trip and expressing a hope that time would be kept, or his trip would be valueless. The driver reassured him, but before many miles had been covered it was apparent that time would not be kept unless there was a decided quickening and the passenger again made an appeal; this, I think, was about Slough. A hurried colloquy then ensued between the driver and the fireman with the result that the fire-shovel was plied much more briskly and the miles that had taken about 68 or 69 sec. to cover were now reeled off in 60 or 61. A shouted warning from the fireman to 'Hold fast through the yard' and Reading was left far behind and in due course Swindon reached dead on time. As the footplate was left the driver explained that 'If you hadn't been with us to-day we should have been 5 min. late into Swindon, but we should have saved 6 cwt. of coal. We could easily have picked up 2 min. down the bank into Bath and another 2 min. into Bristol and no one would have said anything if we were 1 min. behind time.' Mr. Rous Martin expressed his regret at spoiling the driver's position in the monthly coal sheet and walked across to get in the up Dutchman for the return journey. On this trip quite different conditions prevailed, the engine all along seeming to have the whip hand of the situation. As they ran through Didcot a minute or two late the driver remarked

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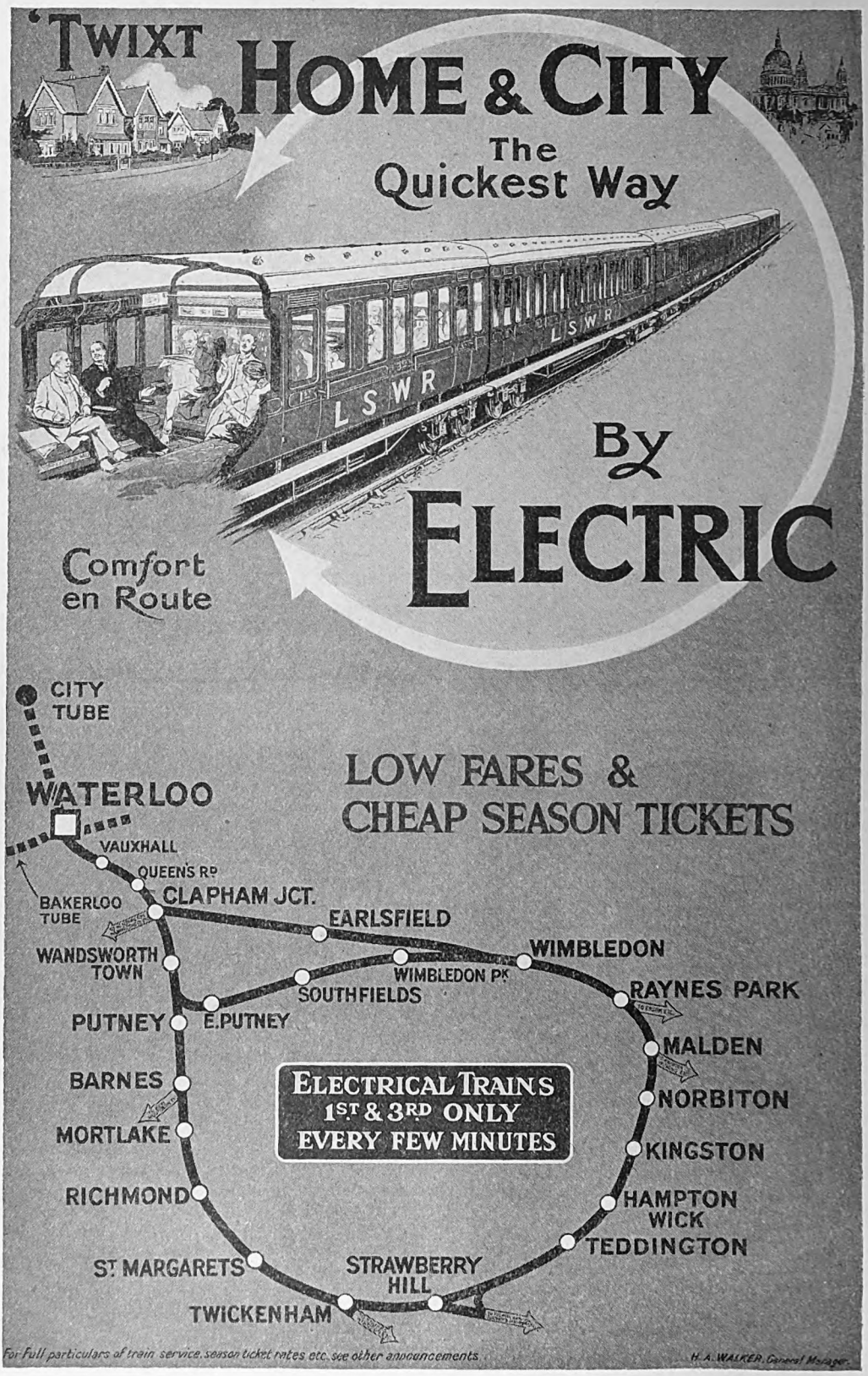

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that 'He never troubled to be to time at Didcot on the up journey,' and indeed the difference seemed like going with the stream compared with pulling against it. A studied ease seemed the prevailing feature on the footplate, only broken once when some adverse signals seemed likely to check them ; firing was quite light and the engine seemed to run almost of itself, so easy seemed the conditions compared with those on the down trip. This very interesting account amply confirms Mr. Ahron's experiences and is a striking testimony to the difference a slight, almost imperceptible grade, used to make to the fine old single-wheelers of one's youth. That they have gone, never to return, must cause a feeling of regret to those, who like myself, remember the single-wheeler as a never-failing source of pride and satisfaction."

London and South Western Railway Electrification.

As announced in our fully illustrated article last month dealing with this important undertaking, electric trains commenced to work the Waterloo–East Putney–Wimbledon route on Monday, October 25th. The week-day train service arranged for provides trains every 20 min., leaving Waterloo at 14, 34, and 54 min. past each hour ; similarly from Wimbledon at 2, 22, and 42 min. past each hour. The first train leaves Waterloo at 5.54 a.m., thence continuing until 11.34 p.m., with a last train at 12.20 a.m. The only exceptions are trains at 5.12 and 6.32 p.m., instead of 5.14 and 6.34 p.m. In the opposite direction trains leave Wimbledon Park at 5.24, 5.44, and 6.4 a.m., the regular service from Wimbledon commencing at 6.22 a.m. and continuing until 11.42 p.m. The new schedule, though all trains serve every station on the route, involves a considerable acceleration upon the times hitherto in force, and the following comparison is of interest :—

	Old times.	New times.
Waterloo	0	0
Vauxhall	5	3
Queen's Road	9	6
Clapham Junction ..	14	10
Wandsworth Town ..	18	12
East Putney	22	15
Southfields	25	18
Wimbledon Park ..	28	20
Wimbledon	31	24

In view of the fact that steam trains were relatively infrequent on this branch, often an hour or more apart, residents of the East Putney Southfields, and Wimbledon Park districts will benefit considerably.

As second-class accommodation is not provided on the electric trains, the following notice has been issued : "Second-class accommodation will not be provided upon the electric trains to be introduced on certain sections of the Company's suburban lines, but holders of second-class season tickets available on such portions of the railway may exchange them for first-class season tickets on payment of the proportionate difference in the two rates, or for third-class season tickets, when they will be credited with the *pro rata* difference in the respective charges. Applications for the exchange of such season tickets should be made to the Superintendent of the Line, Waterloo Station, London, S.E. Holders of ordinary second-class tickets will be permitted to travel first-class by such trains upon payment of the excess fare, or third class upon the condition that no allowance will be made from the fare paid."

One of the special posters issued in connection with this undertaking is reproduced on the opposite page.

Train Working on the Midland Great Western Railway.

It is so seldom that we are able to deal with locomotive and train working on this railway, that some notes sent in by a Dublin reader will be of interest. In reference to the 10.30 a.m. express *ex*-Broadstone he mentions that while it is, comparatively speaking, a good train, there is plenty of room for acceleration. On a recent Saturday, with 11 coaches, only one bogie, hauled by *Ballynahinch*, of the "Connemara" (smaller 4-4-0) class which have been working this train largely this summer, 4 min. were gained to Mullingar, though the running was very moderate throughout. On another run recently from Broadstone by the 5 p.m., the load was 18 coaches including four bogies and heavily loaded, hauled by one of the "Celtic" class, *Britannic*. This was but slightly in excess of the normal load for this train. With a 2 min. stop at Clonsilla 85 min. were taken to Mullingar. Our correspondent considers this a somewhat disappointing one, but he states that he is not aware of any other line in Ireland which works such heavy trains unassisted as does the Midland Great Western, with their engines of the "Celtic" class.

Lady Booking Clerks.

It is now so general to find women doing railway work, in the general, district and booking offices, as ticket collectors, restaurant car attendants, porters and carriage cleaners, that they now attract little attention, but one of our Dublin readers, Mr. H. W. Lea, writes pointing out that in many ways the use of women is by no means new on certain Irish railways. He mentions that lady booking clerks have been employed at Broadstone station (Midland Great Western Railway) for the past 20 years, and at Mullingar also for some years past.

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At a meeting of Irish Railway Managers' Conference, held at the Irish Railway Clearing House on October 16th, Mr. M. F. Keogh, General Manager, Midland Great Western Railway Company, was unanimously elected Chairman of the Conference for the year 1916.

* * *

Early in his career Mr. M. F. Keogh obtained, as a parliamentary agent at Westminster, complete familiarity with the intricate routine of private Bill procedure, as also with the work of Royal Commissions and Select Committees. He returned to Ireland in 1898 as Secretary of the old Dublin, Wicklow and Wexford line, now the Dublin and South Eastern. With that office was associated the secretariat of the City of Dublin Junction and the New Ross and Waterford Extension Railways. He did much to promote the loop line which linked the Dublin and South Eastern with the Great Northern, thus enabling the mails to be carried through Dublin with greater convenience; and he was likewise instrumental in bringing to a successful conclusion the negotiations with the Postmaster-General relating to the subsidy agreed to be paid for the improved service. Subsequently he took an active part in the consolidation of the many different stocks that originally formed the Dublin and South Eastern capital. He held the position of Secretary for fourteen years, and during that period rendered services of conspicuous benefit alike to the company and to the public. In January, 1913, he was selected to succeed Mr. Joseph Tatlow in his present position as General Manager of the Midland Great Western Railway.

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At the quarterly meeting of the Superintendents' Conference of the Railway Clearing House, Mr. Arthur Watson (Superintendent of the Line, Lancashire and Yorkshire Railway, and a member of the Railway Executive Committee) was unanimously re-elected Chairman of the Conference for the year 1916, and Mr. Joseph Rostern (Goods Manager, Great Central Railway) was appointed Chairman of the Goods Managers' Conference for the same period.

* * *

Mr. Watson was educated at the Manchester Grammar School and Victoria University, Manchester. In 1890, he was articled to Mr. W. Hunt, Chief Engineer of the Lancashire and Yorkshire Railway, and from 1893 to 1897 acted as assistant to Mr. J. S. Chorlton, one of the resident engineers of the company. During that period Mr. Watson exercised supervision over large and important works which were then being carried out. For two years—first in 1894–5 and again in 1897–8—he served as Honorary Secretary of the Manchester Association of students of the Institute of Civil Engineers, and in the latter year was appointed Central Division Engineer on the railway. In 1899 he became a Resident Engineer, and, holding that position for six years, had the responsibility of superintending the construction of the five passenger and goods stations which the company provided at Bolton. In 1905 he was selected as Assistant Engineer, and in that capacity continued to render valuable service, until appointed to succeed Mr. J. P. Crouch as Passenger Superintendent. Mr. Watson entered upon the work of that office on January 1st, 1911. On the death of Mr. J. Wharton in September, 1911, the office of Chief Traffic Manager was abolished, and the duties of the Passenger Superintendent were extended, Mr. Watson then becoming Superintendent of the Line. On the outbreak of war, Mr. Watson was appointed a member of the Railway Executive Committee, in place of Mr. Aspinall, detained in Germany. On Mr. Aspinall's return the services of Mr. Watson were retained on the Committee.

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Mr. Rostern was appointed to his present position in 1912. He began his railway career as a junior clerk in the office of the General Manager of the Manchester, Sheffield and Lincolnshire (now Great Central) Railway, in October, 1877. On April 8th, 1892, Mr. Rostern was appointed Chief Clerk, and at the beginning of 1899 became Assistant to the General Manager. From 1885 to 1902 he was a well-known figure in the Parliamentary Committee rooms in connection with the promotion of the numerous extensions of the Great Central Railway, and in opposition to other measures affecting that company's interests. He also attended as one of the company's representatives at the International Railway Congress at Washington in 1905, and was a member of Sub-Committee B of the Board of Trade Railway Conference of 1908–9, under the presidency of Sir George Askwith.

* * *

Mr. Edward Moore, who retired from the position of chief solicitor to the Great Eastern Railway on the 7th inst., was born in 1848;

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was educated at Epsom College; was articled to Messrs. Wilkins, Blyth, and Marsland, of St. Swithin's Lane, E.C.; became managing clerk to Mr. White, a solicitor at Epsom; and entered the Great Eastern service in 1872 as solicitor in charge of the Common Law section. He became chief solicitor in June, 1888, taking over the Parliamentary work.

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Mr. Thomas Chew has been appointed Solicitor to the Great Eastern Railway in place of Mr. Edward Moore, who has retired. Mr. Edgar Harry Wybroo has been appointed Assistant Solicitor. Mr. Edgar H. Wybroo, was born in 1861, and entered the service of the Great Eastern Railway Company in 1877. For twelve years he devoted himself entirely to conveyancing work under the late Mr. C. S. Damant, who was, from 1876 to 1906, chief of the conveyancing department. In 1888, when Mr. Moore was appointed solicitor-in-chief, Mr. Wybroo rendered direct assistance to him in a variety of directions, including Parliamentary matters—drafting and settling clauses, and so forth. He also had much to do with the establishment and working of the Superannuation, Pension, Pension Supplemental Accident, and Sick and Orphans' Funds. In 1906, on the retirement of Mr. Damant, Mr. Wybroo became chief of the conveyancing department, but continued to assist the chief solicitor in other capacities.

* * *

On October 12th, Mr. Guy Calthrop, General Manager, London and North Western Railway, presented to Mr. R. F. C. Castleman, who has recently retired from the position of District Manager of the Crewe district, a silver tray, lamp, hot-water jug, and a cheque, subscribed for by his brother officers. Mr. Calthrop, in making the presentation, read the inscription on the tray, which was as follows: "Presented to R. F. C. Castleman by the chief officers of the London and North Western Railway Company on his retirement, in appreciation of his long and faithful services extending over a period of fifty-two years, and his good comradeship towards his brother officers.—October 12th, 1915."

* * *

On September 24th a large gathering assembled at Broad Street station, when Mr. Arthur Reeve was presented with an armchair on his retirement from the service. The presentation was made by Mr. R. A. Jones, the London Chief Canvasser. In the course of his speech that gentleman stated that Mr. Reeve had commenced his business career with Messrs. Chaplin and Horne at Lincoln in 1872. In 1874 he was moved to Messrs. Chaplin and Horne's chief office at the Swan with Two Necks, London. In 1878, when Messrs. Chaplin and Horne were taken over by the London and North Western Company, he received the appointment of Town Office Inspector, and in 1883 was made Chief Office Inspector. For sixteen years he held this position, and then assisted in the reorganisation of the accounts department, Camden. Subsequently, he became Assistant Chief Collector, and since 1906 has held the position of Assistant Chief Canvasser in the London district.

* * *

Mr. W. H. Maunder, of the Audit Office, Paddington, who, for upwards of fifteen years, held the position of Superintendent of the Paddington Division of the St. John Ambulance Brigade, received an appointment, on May 12th last, as Sergeant-Major (ranking as first-class Warrant Officer) in the Royal Army Medical Corps, for duty at the Military Hospital, Hillingdon House, Uxbridge. On August 18th, he was transferred to the Royal Herbert Hospital, Woolwich, to take up the duties of Chief Ward Master. There are 1,154 beds at this hospital. The duties of the appointment include the supervision of the arrival of convoys of wounded from the front and their removal by stretcher-squads, etc., to the various wards. There are three convoy parties of orderlies, trained specially for this work; and on an advice of a convoy of wounded arriving at Well Hall station (South Eastern and Chatham Railway), the ambulance train is met by about twenty stretcher-squads of four men each, who unload the train and load the motor ambulances in waiting for despatch to the Royal Herbert Hospital, where a like number of stretcher-squads are waiting to receive them. Sergeant F. C. Warren and Corporal W. H. Teagle, formerly of the Great Western Railway Engineer's Office, Paddington, are also doing duty at the Royal Herbert Hospital at Woolwich.

* * *

Sir Albert Stanley, Managing Director, Underground Electic Railways of London, Ltd., gave a paper on "London Traffic in 1913," at a meeting of the International Engineering Congress, held in San Francisco, in September. This ranks as one of the most complete and comprehensive compilations of its kind. The author commences by emphasising the peculiar and unique conditions which London traffic facilities have to provide for, and which render comparison impossible with any other great city. Yet, as he points out, the transport equipment provided, owing to the unco-ordained character of the traffic facilities, involves (1) isolation and lack of correlation between urban and trunk railway systems; (2) conflict between tramways and motor-'buses; and (3) an indefinite situation as regards motor-'buses. A partial solution of the difficulty is provided by the correlation of underground and suburban lines of which the country lines of the District Railway, and its associations with the London and South Western Railway in the south-west, and with the Midland railway in the east, and of the Metropolitan Railway with the Metropolitan and Great Central lines in the north-west are cited as older examples, while the extension of the London Electric "tube" line to join the London and

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North Western Railway is mentioned as an instance of a tendency which is likely to be considerably extended in the future, and which will go far to realise the desired correlation of inner and outer traffic facilities.

* * *

COMMENCING Monday, October 11th, 1915, restrictions were enforced in regard to entrance and exit from Dover, in accordance with the following instructions laid down by the Military Authorities :—"Entrance to and exit from Dover will be permitted only (a) by railway (*i.e.*, by train only); (b) by the following roads (detailed on official notice); and (c) by sea (under special conditions), subject to the production at railway stations, examining guards, etc., of certificates or passes as hereafter detailed. Civilians must produce a National Registration Certificate; or if they were on August 15th, 1915, (a) twelve years of age and over, but under the age for registration (viz., fifteen), or (b) beyond the age for registration (viz., over sixty-four), a special pass, which can be obtained of the Chief Constable at the Police Station, Town Hall, Dover. Children under twelve will not require a pass. Civilians wishing to enter Dover without a National Registration Certificate or a pass will have to submit at the railway station or the examining guard very satisfactory reasons for not having a certificate and for wishing to enter the town, and will only be permitted to do so after the registration of their names, etc., if a *bonâ-fide* case is shown. This arrangement will only be in force temporarily, and after a short period production of National Registration Certificates or passes will be insisted on. Holders of travelling passes to and from Dover and Kearsney will require to be in possession of their National Registration Certificates to produce to the Military Authorities if called on to do so."

* * *

COMMENDABLE work is being done by a Committee representing the whole of the Great Western Railway staff at Shrewsbury. This was formed in August, 1914, with the object of collecting funds for war purposes and to look after the dependents of railwaymen who had enlisted. Among other things subscribed for was the provision of a bed in the new King George Hospital in London. At the opening ceremony at the hospital, which was attended by the secretary to the Committee, it was stated that out of 1,650 beds this one was unique, inasmuch as it was the only one subscribed by a railway staff. A tablet at the head is inscribed: "Great Western Railway Staff, Shrewsbury, Bed." From the beginning of the war to October 4th the Committee of the Shrewsbury staff had collected £309 1s. 9d. Nearly two hundred Great Western men from the various departments at Shrewsbury are serving in the Army; this represents 20 per cent. of the entire staff.

* * *

THE yearly report of the Railway Benevolent Institution this year gives merely an account of the proceedings at the annual dinner held May 4th, the fifty-seventh annual meeting held June 23rd, and the Orphanage meeting at Derby, June 16th. With it is issued the following notice: "To subscribers and members.—In consequence of the war, and in view of the possible increase in the number of applications by members and widows and on behalf of children for assistance, and the need, therefore, for husbanding the resources of the Institution, the Board of Management have decided not to issue with the annual report the usual detail particulars of subscriptions and donations; but any contributor can, on application to the secretary, obtain a certificate of verification of any payment made during the financial year ending April 30th, 1915."

* * *

THE Underground Railway and the London General Omnibus Company have issued a series of appeals for recruits, which, it is hoped, will be effective as forming a contrast to the stereotyped posters now on the hoardings. They take the form of quotations from some of the great figures in history, who have inspired their countries at a time when they were menaced by wars of aggression similar to that which Europe has to face to-day. The appearance of the posters coincides with Lord Derby's final trial of the voluntary system, and if it is possible at this period of the war to rouse men by appeals to their patriotism, these vivid glimpses of nations in their hours of greatest trial should have that effect.

* * *

THERE is a great deal in the names of railway stations, and the Metropolitan and Great Central Companies have very wisely decided to alter the names of two of the existing stations in their rural district so as to give passengers on the Extension line a clearer idea of the nearest point at which well-known beauty spots can be reached by train. Two of the loveliest old-world villages in England are Latimer and Chenies, and their position can now be easily identified from the fact that Chalfont Road station will in future be known as "Chalfont and Latimer" and Chorley Wood as "Chorley Wood and Chenies." By the way, Chenies is pronounced "Chayniz," and not "Cheenies," as some people say.

* * *

THE North British Locomotive Co., Ltd., will shortly commence delivery of the 20 4-6-0 ("Prince of Wales") passenger engines which the London and North Western Railway sometime ago ordered from them. The first five will bear Nos. 136 *Minerva*, 173 *Livingstone*, 257 *Plynlimmon*, 446 *Pegasus*, and 1749 *Precedent*. The delivery by Messrs. Beyer, Peacock & Co. of 20 0-8-0 superheater goods will also be shortly commenced. At the end of September, the London and North Western Railway had a total of 301 engines fitted with the Schmidt superheater, as follows:—20 4-6-0 4-cyl. pass., "Claughton" class; 1 4-6-0 4-cyl. pass., *Prospero* (converted "Experiment"); 40 4-6-0 pass, "Prince of Wales" class; 90 4-4-0 pass.,

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"George the Fifth" class; 20 4–4–0 pass., "Precursor" class (converted); 36 4–6–2 pass. tanks; 101 0–8–0 goods.

* * *

As from October 18th, all parcels and miscellaneous traffic, which, prior to that date, had been received at and forwarded from North Leith station, North British Railway, is now dealt with at Leith Central. This arrangement, however, does not apply to fish traffic from or to Newhaven Fish Market, nor to full truck loads of passenger train traffic for certain engineering firms presently engaged at the docks. Leith Central, as its name implies, is more in the centre of the city than North Leith, and being a very commodious station, should suit both the traders and the Company better.

* * *

THE London and South Western Railway announces that the whole of the rail motor services between Twickenham, Hounslow and Gunnersbury have been discontinued.

* * *

OWING to the demands on railway staff for military and other duties, the North Eastern Railway Company gave notice that their Nottingham district agency office in that city would be closed on October 31st for the period of the war.

* * *

MR. J. R. BALL has been appointed to take charge of the Estate Department, London and North Western Railway. The whole of his service with the Company has been spent in the Estate Department, which Mr. Ball joined in 1881. He has since served under the late Mr. Charles Hull and became chief assistant to Mr. Edward Mackie who has just retired and whom Mr. Ball follows as chief of the department. Mr. Ball is a Fellow of the Surveyors' Institute.

* * *

COMMENCING November 8th the North London Railway made important reductions in their train services. In addition to discontinuing a number of trains running from Broad Street to Poplar, Bow and South Bromley on weekdays, the services on Sundays is now half-hourly in each direction, instead of every quarter of an hour. Trains leave Poplar for Broad Street at 16 and 46 minutes past each hour from 7.16 a.m. to 11.16 a.m., and again from 12.46 p.m. to 10.46 p.m. Trains to Poplar leave Broad Street at 20 and 50 minutes past each hour from 7.50 a.m. to 11.20 a.m., and again from 12.50 p.m. to 11.20 p.m. and at 11.35 p.m.

* * *

A REMARKABLE incident occurred at the Midland Railway lost property sale at Derby on November 3rd. On a keg of methylene blue being put up, the bidding opened at 5s., which modest sum was quickly advanced upon, first to £100, then £200, then £300 was passed, and, finally, an exceptionally resolute bidder secured the much-coveted dye at £310. The war was responsible for this record price. In the piping times of peace this particular dye would have been worth about 2s. per lb., but this purchaser must have paid about 36s. per lb. The keg in question weighed about 1½ cwt., and prior to the war would have been worth from £12 to £15. Needless to say, the incident created considerable excitement.

* * *

WITH so many calls on private purses by reason of the European war there is a risk that our railway orphanages may not receive the same measure of support accorded them in the past. The Board of Management of the Home for Orphans of the South Western Railway Servants, Woking, Surrey, earnestly appeal for help towards the £2,500 per annum required for the maintenance of the 130 fatherless boys and girls for whom they provide a home. Christmas is coming and in order that the children may enjoy the cheer customary at this season it is hoped gifts both in money and in kind will be made by railway travellers, particularly those who frequently use the London and South Western line. Mr. H. G. Warne, the secretary, will be pleased to hear from friends of the home, both old and new.

* * *

MR. FRANK POTTER, General Manager, Great Western Railway, has been elected Chairman for 1916 of the General Managers' Conference of the Railway Clearing House. Mr. Frank Potter has also been appointed for the year Chairman of the Board of Management of the Railway Benevolent Institution. At the age of 14, Mr. Potter joined the Great Western Railway as a boy clerk in the goods department at Paddington. In 1877 he was sent, as a junior, to the office which he now directs. Later he was attached to the passenger department at Windsor, and subsequently gained valuable experience as stationmaster in other towns on the system. In 1888 he was selected as the chief clerk in the office of the Superintendent of the London division, where he remained for six years. During a portion of this period he was actually, though not nominally, in supreme control of the division. It was there that Mr. Potter won the high appreciation of all the ruling authorities at Paddington. Another change in his career occurred in 1894, when Mr. T. I. Allen succeeded Mr. Burlinson as Superintendent of the Line. Mr. Potter was transferred to the office of the General Manager, and two years later further promotion came to him consequent upon the appointment of Sir Joseph Wilkinson, as General Manager, in the place of Mr. Henry Lambert. Sir J. Inglis followed Sir J. Wilkinson, and twelve months after the appointment of the former, Mr. Potter was promoted as his chief assistant. In December, 1911, Mr. Potter was appointed to his present position. He is a member of the Railway Executive Committee.

* * *

WE regret to announce the death of Mr. J. H. Adams, Locomotive, Carriage and Wagon Superintendent, North Staffordshire Railway. He was the third son of Mr. William Adams, C.E., late Locomotive Superintendent of London and

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South Western Railway. Born in September, 1860, the late Mr. Adams was educated at the Brighton Grammar School, Thanet College, and privately in Brussels by the Rev. A. K. Harlock, British Chaplain. He commenced his apprenticeship at Stratford Works, Great Eastern Railway, under his father in 1877, and when Mr. William Adams succeeded Mr. William George Beattie, as Locomotive Engineer of the London and South Western Railway, he was transferred to Nine Elms. Upon the completion of his training he served as a fireman for 9 months, and afterwards had charge as an engine driver of goods and passenger trains for fifteen months on the London and South Western Railway. One year was spent with Messrs. Tannett, Walker and Co., Leeds, to gain experience in hydraulics. From July, 1887, to September, 1898, he served as Locomotive, Carriage and Wagon Superintendent of the Dona Thereza Christina Railway in Brazil. From January, 1899, to March, 1902, Mr. Adams was Assistant Manager of the South Eastern and Chatham Railway locomotive works. In March, 1902, he was appointed Locomotive, Carriage and Wagon Superintendent of the North Staffordshire Railway in succession to the late Mr. Luke Longbottom, taking up his duties in the following month. During the years which have elapsed since that date Mr. J. H. Adams was responsible for many interesting and notable developments in respect of North Staffordshire rolling stock, and in connection with the improvement of the workshops at Stoke-on-Trent. We may refer to a comprehensive article published in the RAILWAY MAGAZINE for November, 1913, dealing with the Stoke Works and its output.

* * *

ON another page the ambulance train equipped by the London, Brighton and South Coast Railway for service in France is described, and dates on which it was exhibited at principal stations are there stated. At Brighton and other South Coast resorts there have been large numbers of visitors, and on Wednesday, Nov. 10th, at London Bridge, the train attracted great attention. On that day it was inspected by the Lord Mayor (Sir Charles Wakefield), this being his first public appearance after being installed in his new office. He was received by the Earl of Bessborough, Sir Philip Rose, Bt., and Sir William Forbes, on behalf of the London, Brighton and South Coast Railway Company, and spoke in terms of praise of the train and its equipment. On Thursday and Friday the train was on view at Victoria (Brighton) Station. The Mayor and ex-Mayor of Westminster made a visit of inspection on Thursday morning. This train has been built at the Company's works at Lancing, under the supervision of Mr. A. H. Panter, carriage and wagon superintendent. Mr. W. L. Girling, superintendent of the Railway Division, St. John Ambulance Association, was in charge at the public inspections. A further inspection at West Croydon was arranged for Monday, November 15th.

THESE are sad days for railway speed enthusiasts, although those who study railway affairs as a whole find the times full of lively interest and there is a rich reward for the observer who comprehends there exists a military reason for much that is mysterious in current railway working. Apposite, therefore, was the subject chosen by the Rev. W. J. Scott, B.A.—"War's Ravages in British Train Services"—for his lecture at the November meeting of the Railway Club (London). Mr. W. Parker presided and among those present were Captain J. G. Burnett and the Superintendent of the Metropolitan District and allied railways, Mr. W. E. Blake. Mr. Scott handled his subject in his inimitable manner; his shrewd comments, keen observations, witty digressions and kindly criticisms were thoroughly appreciated. In the ensuing discussion Mr. Blake, Mr. E. J. Miller and others ably participated. The next meeting will be held at headquarters, 92, Victoria Street, London, S.W., on Tuesday, December 14th, at 7.30 p.m., when Mr. A. W. Bartlett will present a paper concerning the Great Eastern Railway Cambridge main line.

* * *

IN view of the interest centreing round the subject of recruiting, it is noteworthy to record from figures recently issued by the Railway Executive Committee, that the percentage of men who have enlisted from the Metropolitan District Railway staff is considerably higher, with one exception, than any other of the controlled railways. At the commencement of the war the total number of men employed was 2,499. Up to August 31st, of this year, the number of men enlisted was 769. This shows a percentage of 30 per cent. of the staff employed, who have enlisted.

* * *

AT the meeting of the Highland Railway Directors held on November 4th, Mr. W. Whitelaw (Deputy-Chairman) presiding, a letter was submitted from Mr. R. M. Wilson, Glasgow, intimating that, owing to his indifferent health and the extra work thrown upon him in the South through the war, he was unable to continue to act as Chairman of the Company, a post he had held for three years. The Directors accepted Mr. Wilson's resignation with great regret, and elected Mr. Whitelaw to the Chairmanship and Mr. Albert E. Pullar, Perth, to the Deputy-Chairmanship. Mr. Whitelaw, in accepting the Chairmanship, which he had held for a former period, said he did so only for the period during which the Government controlled the railways.

* * *

THE Directors of the Midland Great Western Railway, at their Board meeting on November 9th, appointed Mr. W. H. Morton, M.I.Mech.E., Assistant Locomotive Engineer and Works Manager, to be Locomotive Superintendent, in succession to Mr. E. Cusack, resigned.

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Railway Literature.

THE SYREN AND SHIPPING: 1,000th number. To celebrate its 1,000th issue our contemporary has prepared a special number (price 1s.), which should be in the hands of all concerned with shipping and kindred industries. It is prepared in the artistic and high-class style usual with this valuable publication, and includes over fifty signed articles by authoritative writers. In introduction Mr. Lloyd George sends the following message to the men of the mercantile marine through the medium of *Syren and Shipping*:—

"The country owes a great debt to its mercantile marine. Our merchant shipping has been called upon to bear its share—no small share—in this great European struggle. New conditions have had to be met, arduous duties undertaken, long hours worked, and many difficulties overcome As our armies are fighting overseas, and in some cases at great distance from our shores, a heavy burden has been imposed of necessity on the men of our mercantile marine on whom we must rely for the prompt and sure transport of munitions of war and other material without which the best efforts of our brave men at the front would be in vain; and I am convinced that the nation can depend on the same patriotic and devoted service in the future as in the past."

Space will not permit of a detailed review of the articles included, but two may be specially mentioned. One is by Lord Inverclyde on "Railway Companies as Steamship Owners." Lord Inverclyde, in his article, draws attention to the disadvantage to shipowners, and in some cases to the public, of railway companies having power to own and run steamers. The matter is accentuated, at the present time, by the arrangement arrived at between the Government and railway companies during the war, whereby, although the expense of running railway-owned steamers is at present enormously increased, it does not appear necessary for the railway companies to raise their rates. His Lordship points out that this places the *bona fide* shipowner at a great disadvantage, whether he is competing directly or indirectly with railway-owned boats, and for this reason: Shipowners' expenses have been enormously increased, and the owner is faced with the problem of either not raising his rates and running his steamers at a loss, or raising his rates with the risk of traffic being diverted to railway steamer routes.

Another article to which reference may be made is by Mr. J. H. Vickery, General Manager, Alexandra (Newport and South Wales) Docks and Railway Company, on "Newport's Recent Growth as a World Port."

After describing the development of Newport and dealing with the advantages and equipment of the Port, including mention of the additional facilities provided by the Alexandra Company during recent years, Mr. Vickery points out that the docks are served by a network of railway lines and sidings upwards of 100 miles in length. Three main lines lead directly from the dock lines to the Great Western Railway South Wales main line, the Monmouthshire Valleys and the Glamorganshire Valleys. There are also connections with the London and North Western, Midland, Rhymney, Taff Vale, Rhondda and Swansea Bay and Brecon and Merthyr systems. The Company's own line connects directly at Pontypridd with the Taff Vale Railway, affording communication with the whole of the collieries in the famous Rhondda, Aberdare and Merthyr Valleys, and by the same means with the Rhymney Valley, served by the Rhymney and Brecon and Merthyr Railways, the Company thus being in a position to bring traffic to Newport from any part of the South Wales coalfield. The Company obtained powers in 1911 to construct an independent line to Nine Mile Point, to form a junction with the London and North Western Railway, with the object of giving a direct route between the Sirhowy Valley and the Alexandra Docks. This line, when constructed, will also open another door between Newport and the Midlands, for which Newport is the nearest ocean port on the north side of the Bristol Channel.

* * *

THE MAGNET OF COMMERCE. First Series. No. 2. The first edition of "The Magnet of Commerce," issued by the Great Central Railway, was published a year ago, and has met with such widespread appreciation that the whole of the edition was exhausted in a few months. It was reviewed by over 200 newspapers and trade journals, and without exception the comments were most favourable. A second edition has, therefore, been issued by the Publicity Department, with revised statistics where necessary and a few changes and developments. The developments which are constantly taking place in the important coalfields and industrial centres of Lancashire, Yorkshire, Nottinghamshire, Derbyshire and elsewhere, and the opening of the new dock at Immingham call for a production which will periodically give interesting and useful information to the coal owner and colliery manager, as well as the exporter and the numerous business firms and traders associated with coal, colliery machinery, etc. This purpose is admirably filled by this publication which, though prepared and issued by the Great Central Railway, is of general application and does not consider only those coal areas in which the Great Central Railway is mainly concerned.

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ENGLISH RAILWAYS: THEIR DEVELOPMENT AND THEIR RELATION TO THE STATE. By Edward Cleveland-Stevens. [George Routledge and Sons, Ltd. Price 6s. net.] This book aims at presenting a detailed historical account of the consolidation of English railways, up to the year 1900, dealing particularly with amalgamation as affecting railway communications in general, and as viewed by Parliament and the Public, and controlled by Parliament in the interests of the Public. Mr. Cleveland-Stevens' work considers turn-pike roads, railway problems and Parliament, canals and railway competition, Gladstone's Act, the railway campaign of 1872, the attitude of Parliament, etc. There are two maps; one showing the railway systems now under the control of the principal railway companies, and the other showing existing railways in June, 1848. The work is strictly limited to historical treatment, it being considered that before modern railway problems could be studied, an essential preliminary requirement was a statement of the historical facts, unencumbered with judgments or opinions on those problems. The order of treatment observed is mainly chronological.

* * *

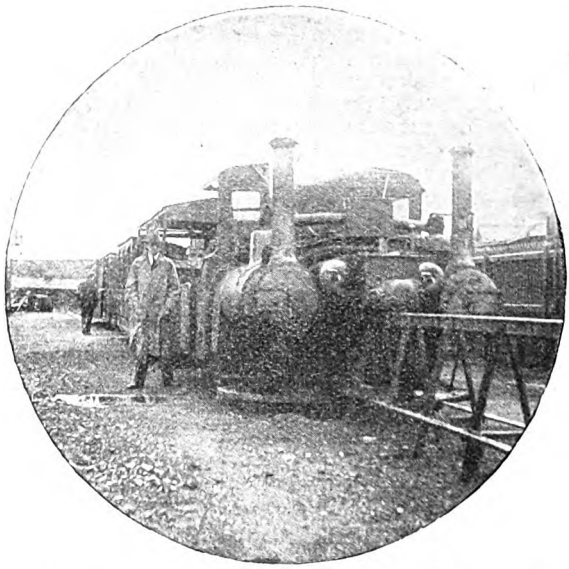
MESSRS. MURPHY, STEDMAN & CO., LTD., of 180, Gray's Inn Road, Holborn, London, W.C., send a copy of their new 1915 catalogue. The firm is making a very large issue of this catalogue, the number running into five figures, and are sending copies all over the world, on the principle that now more than at any time British traders should bring their goods into prominence (even if they are not in a position to execute outside orders at the immediate moment). The range of subject matter is a wide one, from foundry plant to electric cranes and capstans, including specialties of other firms for whom Messrs. Murphy, Stedman & Co. act as agents or contractors.

* * *

PAINTING BY IMMERSION AND BY COMPRESSED AIR. By A. Seymour Jennings. [*The Managing Engineer*, 93 and 94, Chancery Lane, London, W.C. Price 10s. net.] This book claims to be the only one on the subject of which it treats, and is of interest to many industries. Various methods are reviewed, and the relative merits and adaptability of each are fully discussed, from ordinary lime-washing and similar plants to relatively elaborate artistic equipments. A chapter is devoted to a description of a portable paint sprayer for railway and other work. This is an American installation for painting freight cars; and more might be said in reference to railway applications. On the whole, however, this book is of a comprehensive and eminently practical character, and may be commended to all concerned.

* * *

MESSRS. JOHN BARTHOLOMEW & CO. send a copy of their new and revised edition, included in their special war map series, of the Italian and Balkan States map. This embraces the whole of Italy, the Trentino, a large part of Austria-Hungary, all the Balkan States, Greece, Turkey in Europe, and the greater part of Turkey in Asia. Size, 30 inches by 40 inches. Prices, 1s. paper; 2s. 6d. cloth; on rollers, 6s.



Photo] [*K. A. C. R. Nunn.*

LISTOWEL AND BALLYBUNION RAILWAY.

12.50 p.m. mixed train at Listowel. Mono-rail locomotive No. 1.

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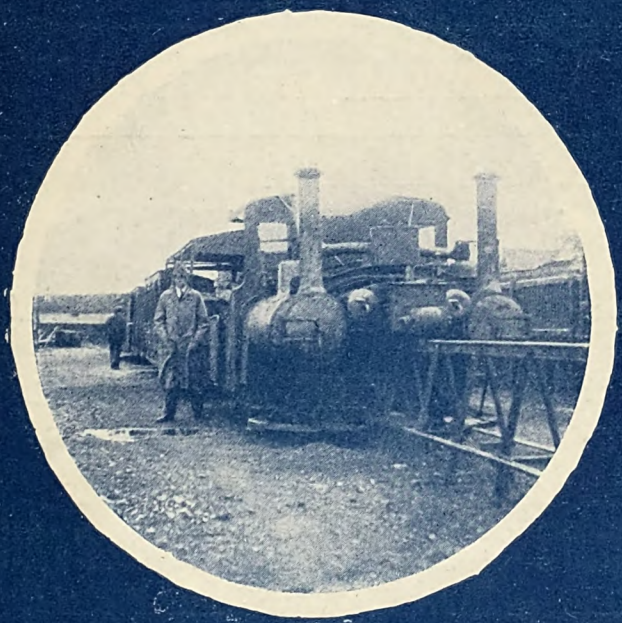

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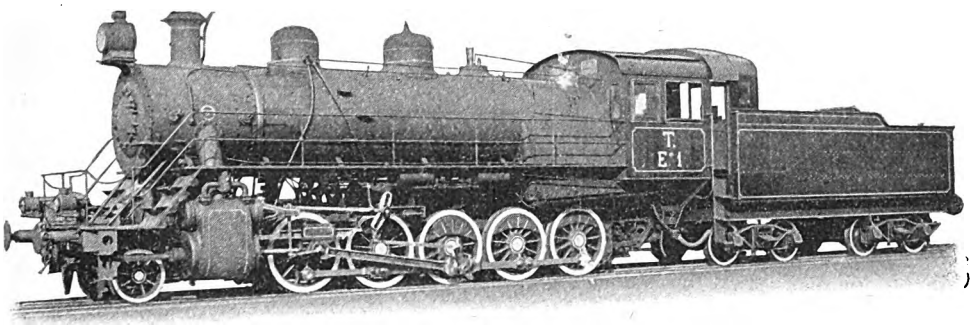

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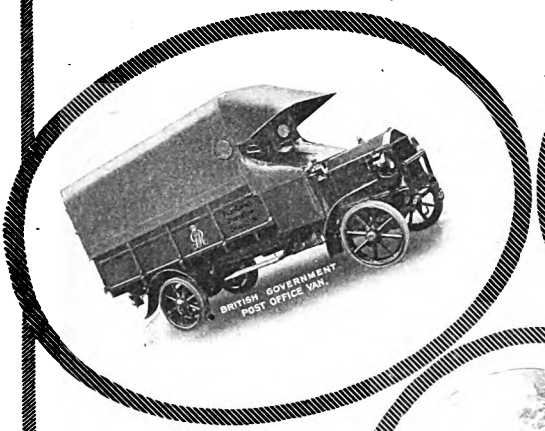

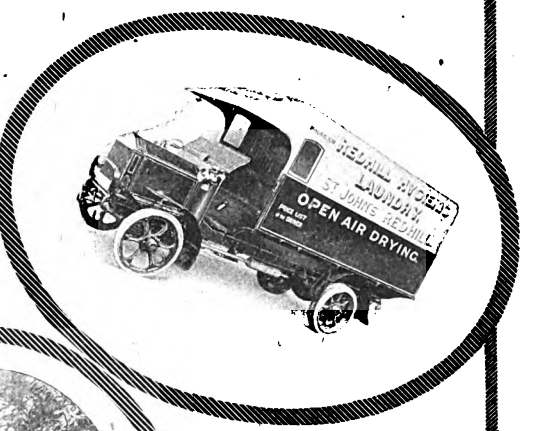

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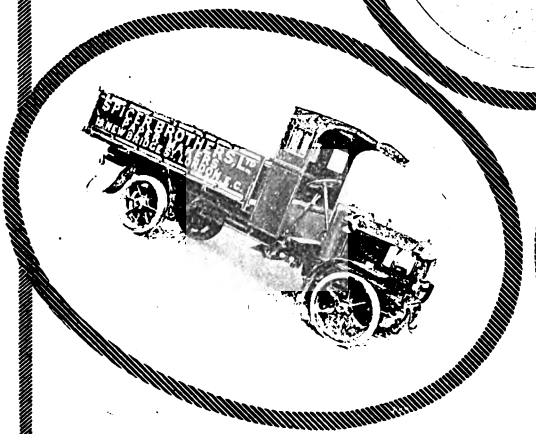

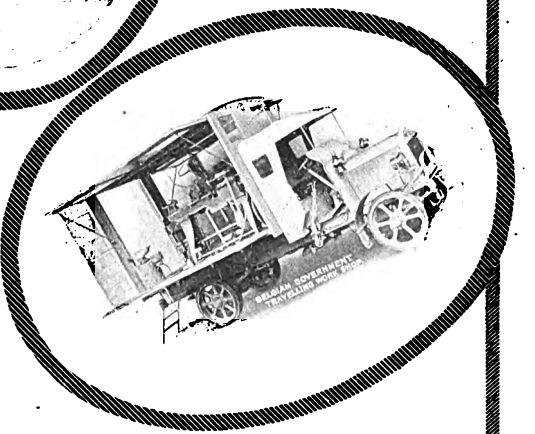

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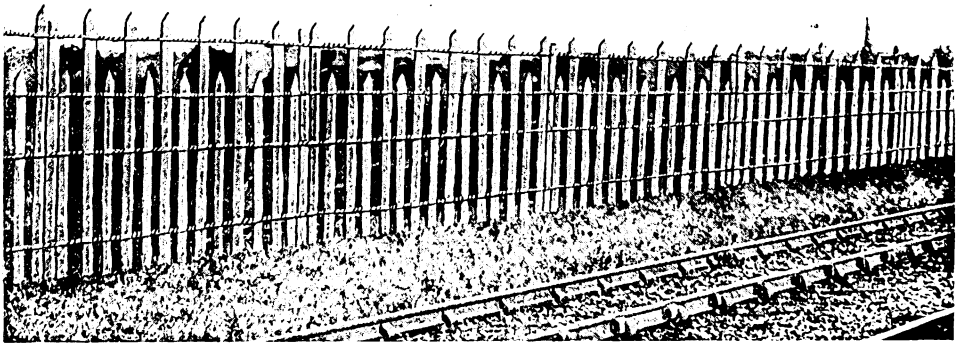

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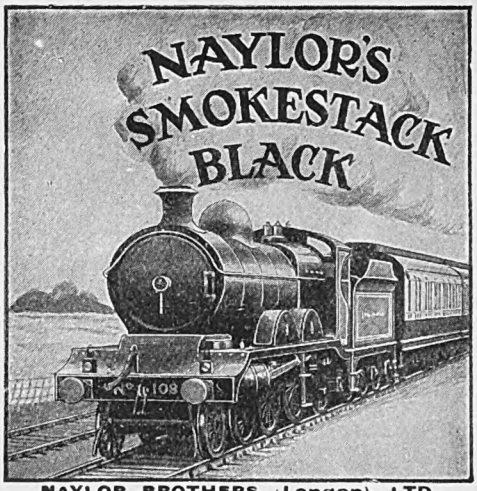

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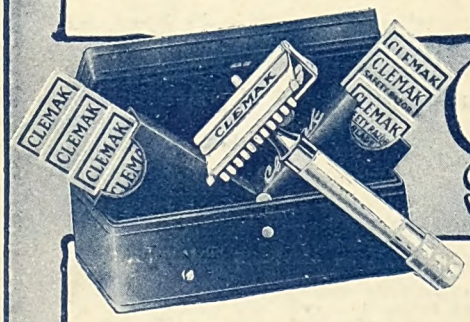

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